ONTARIO MINISTRY OF ENVIRONMENT
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LEVELS
OF
METALS AND NON METALS
IN
VEGETATION
GROWING ON DEPOSITS OF
MINERAL TAILINGS
IN THE
PROVINCE OF ONTARIO

1984

BY

JOHN R HAWLEY

WATER RESOURCES BRANCH

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INTRODUCTORY STATEMENT

The function of this report is to outline the levels of 23 substances (mostly metals) that are found in various types of vegetation growing on mineral waste (tailings) disposal areas in Ontario. Specifically, this report involves itself with 19 species of vegetation growing on 62 mineral waste disposal areas in the Province. Relevant background samples of the species of vegetation investigated are also discussed.

Because of the common occurrence of the vegetation sampled for this report, the findings of this study may, to some extent, be extrapolated to other industrial or municipal waste disposal sites in the Province.

IMPORTANT NOTES

(1) Unless otherwise indicated, all analytical results given in this report are expressed as "parts per million".

(2) All vegetation analytical results quoted in this report are based on the Dry Weight of the vegetation in question.

(3) The symbol " - " appearing before a result (i.e. - 0.5 ppm) means "less than".

(4) The symbol " = " appearing before a result (i.e. = 0.5 ppm) means "greater than".

(5) Only the above-ground portions of plants were sampled for this study. Samples of roots or root systems were not taken.

(6) The vegetation samples were not washed prior to analysis. All samples were visually clean at the time of collecting.

(7) In general, the vegetation sampled for this report was growing in areas remote from the influence of active smelters, refineries and similar sources of airborne contaminants.

(8) Only specimens of roughly the same age, maturity of foliage and coming from similar positions on the plants being sampled were collected.

(9) Relevant background (vegetation) samples were taken in selected locations around the Province. The word "Paleozoic" or "Precambrian" is appended to each background analytical result. The word "Paleozoic" indicates that the vegetation sampled was growing in an area underlain by Paleozoic bedrock. Similarly, "Precambrian" indicates that the vegetation sampled was growing in an area underlain by Precambrian bedrock.

EXECUTIVE SUMMARY

At the present time, over 25,000 acres of land in Ontario are covered by finely divided mineral processing wastes called "tailings". Exposed tailings areas can give rise to a number of environmental problems including the following:

(1) Leaching of contaminants with the subsequent impairment of downstream areas and ground water etc.

(2) Erosion; failure of tailings dams and decant structures. Large volumes of contaminated sediments can be carried to downstream areas.

(3) Blowing of contaminated tailings to areas remote from the original disposal site.

(4) Contamination of vegetation and animal life by metal uptake and bio-accumulation.

One popular and useful solution to many of these problems is the reclamation of mineral waste disposal areas by revegetation.

Properly carried out, revegetation of inactive disposal sites can:

(1) Provide a self-maintaining permanent cover.

(2) Prevent erosion (by water and/or wind).

(3) Reduce or eliminate seepage and/or runoff.

(4) Return a despoiled site to an aesthetically pleasing condition.

(5) In some cases, permit alternate uses of the site (parkland, etc.)

All revegetation strategies, however, must take into consideration two vital facts:

(1) Mineral tailings frequently contain significant amounts of environmentally reactive, hazardous and/or toxic substances, and

(2) Plants (and animals) sometimes exhibit an ability to concentrate, within their structures, abnormal amounts of environmentally undesirable substances.

An investigation into (1) above resulted in a Ministry of the Environment report entitled "The Chemical Characteristics of Mineral Tailings in the Province of Ontario (J.R. Hawley; 1979). (2) above is the subject of this report.

Current technical literature abounds with references that note high metal levels in plants growing on mine waste disposal areas. Most of these references, however, share one common failing. While the references in question state the level of a particular substance (usually a metal) in a specific type of plant growing on a mine waste disposal area, the same references usually fail to mention the average level of the substance being discussed in the plant when that plant is not growing on a mine waste disposal site. In other words, the natural background level of the substance in the plant is usually ignored. Conclusions based on this type of data can be misleading.

The main function of this report is to outline the levels of 23 substances (mostly metals) that are found in various types of vegetation growing on mineral waste disposal areas in Ontario. This is done in the "Detailed Summary" and in "Appendix B" of this report.

Certain broad observations can be made from the detailed data presented in this report:

(a) In approximately 21% of the cases examined during the production of this report, parameter levels in the "background" plants were higher than the parameter levels in plants growing on mine waste disposal sites.

(b) In approximately 36% of the cases examined during the production of this report, there did not appear to be any significant difference between the parameter levels noted in "background" plants and the levels noted in plants growing on mine waste disposal sites.

When (a) and (b) are taken together, it appears that in more than one-half (57%) of the cases examined during the production of this report, parameter levels in plants growing on mine waste disposal sites were equal to or lower than the levels found in comparable "background" plants.

(c) Parameter levels in plants growing on mine waste disposal sites were greater than the levels in comparable "background" plants in only 43% of the cases examined. While these cases are a definite cause for concern,, it should be noted that, in a great many of the 129 cases falling into this category, the differences in parameter levels were not spectacular. Sixteen of the cases were questionable.

(d) Of the 23 parameters investigated, only 7 appear to present problems or potential problems. In alphabetical order, these are:

(1) Arsenic
(2) Cobalt
(3) Copper
(4) Lead
(5) Molybdenum
(6) Nickel
(7) Zinc

(e) Arsenic, molybdenum and nickel appear to give rise (in the order quoted) to the greatest potential environmental problems (contamination of vegetation). Levels of these substances in plants growing on mine waste disposal sites were consistently higher than levels in comparable "background" plants.

(f) Following arsenic, molybdenum and nickel, cobalt is of concern. The frequency of elevated levels of cobalt (in plants growing on mine wastes) is somewhat less than that of nickel but not greatly so.

(g) Zinc and copper follow cobalt. On the basis of the frequency of elevated levels in plants growing on mine wastes, zinc and copper appear to be almost identical. Zinc, however, tends to display some spectacular excesses and, therefore, may be of greater concern than copper.

(h) In order of importance, lead appears last on the list of 7 parameters of concern. Lead has the potential to be a significant environmental problem because of it's known toxicity. However, in the case of plants growing on mine wastes in Ontario, this potential does not seem to be routinely realized.

(i) While only 7 of the 23 parameters investigated appear to give rise to the possibility of routine potential environmental problems, most other parameters did exhibit excesses on infrequent occasions.

(j) It is apparent that one logical way to minimize environmental problems due to contamination of vegetation by metals etc., is to ensure that, in any revegetation scheme planned, more than one species of vegetation is used. It is obvious that if a single species of vegetation were to be used to reclaim a large mine waste site and the species in question was susceptible to contamination by, for example, arsenic, serious problems with domestic or wild grazing animals etc., could result. If, instead, five species of vegetation were used and only one was susceptible to uptake of arsenic, the overall problem would be greatly reduced. In the long term, nature usually assures a diversity of vegetation in any area.

DETAILED SUMMARY

This detailed summary outlines, on a parameter-by-parameter basis, the levels of each parameter investigated in the 19 species of vegetation collected. For example, copper levels in all plant species sampled are reported under the single title of "copper". Background copper data are also given.

On the other hand, the complex chemistry of each vegetation sample collected during this study is reported in Appendix B and is arranged according to the species of vegetation being discussed. For example, the complex chemistry of all individual samples of Field Horsetail collected is reported in Appendix B under the title of "Field Horsetail". Background data are also reported.

ALUMINUM

ALUMINUM LEVELS (ppm) in Vegetation

Vegetation Type	Tailings Type	Average concentration or (range)	Ratio Veg./Tailings
Cattail (leaves)	Gold (Non-Acid)	30.4	0.00
	Uranium (Non-Acid)	19	0.00
	Acid Sulphide (Cu, Pb, Zn, Ni)	108	0.01
	Sulphide (Cu) (Non-Acid)	81	0.00
	Silver (As) (Non-Acid)	36	0.00
Background	Paleozoic	51	
Horsetail (excluding roots)	Gold (Non-Acid)	59	0.00
	Silver (As) (Non-Acid)	37	0.00
	Acid Sulphide (Cu, Pb, Zn, Pt)	133	0.00
	Uranium (Non-Acid)	98	0.00
	Sulphide (Cu) (Non-Acid)	29	0.00
Background	Paleozoic	53	
Birch (leaves)	Gold (Non-Acid)	42	0.00
	Uranium (Acid)	53	0.00
	(Non-Acid)	46	0.00
	Acid Sulphide (Cu, Ni)	68	0.00
Background	Paleozoic	67	
	Precambrian	126	

Poplar (leaves)	Gold (Non-Acid)	46	0.00
	Acid Sulphide (Cu, Ni, Pb, Zn)	(110 to 128)	0.00
	Silver (As) (Non-Acid)	57	0.00
Background	Paleozoic Precambrian	54 52	
Tamarack (needles)	Gold (Non-Acid)	40	0.00
Basswood (Leaves)	Gold (Non-Acid)	92	0.00
Aspen (leaves)	Gold (Non-Acid)	29	0.00
Background	Paleozoic	50	
Oak (leaves)	Smelting & Refining Residue (Co, Ag, As)	107	0.2
Mustard (leaves, stems)	Acid Sulphide (Cu, Ni)	137	0.01
Fleabane (leaves, stems, flowers)	Smelting & Refining Residue (Co, Ag, As)	62	0.1
Background	Paleozoic	57	
Vetch (leaves, stems, flowers)			
Background	Paleozoic	57	

Maple (leaves)	Sulphide (Cu) (Non-Acid)	41	0.00
	Gold (Non-Acid)	52	0.00
	Refinery (As) Residue	41	0.07
Background	Paleozoic	52	
	Precambrian	35	
Willow (leaves)	Gold (Non-Acid)	33	0.00
Background	Paleozoic	60	
Trefoil (leaves, stems, flowers)	Uranium (Acid)	(45 to 60)	0.0
	Silver (As) (Non-Acid)	(56 to 115)	0.00
	Gold (Non-Acid)	81	0.01
Background	Paleozoic	66	
Purple Clover (leaves, stems, flowers)	Gold (Non-Acid)	125	0.02
	Acid Sulphide (Cu, Ni)	50	
Background	Paleozoic	98	
Yellow Sweet Clover (leaves, stems, flowers)	Gold (Non-Acid)	38	0.00
	Acid Sulphide (Cu, Ni, Pb, Zn)	63	0.00
Background (white sweet clover)	Paleozoic	50	

Evergreen (needles)	Gold (Non-Acid)	60 (fir) 72 (pine)	0.01 0.00
Background	Paleozoic	52 (pine)	
Grasses (excluding roots)	Uranium (Acid)	49	0.00
	Gold (Non-Acid)	(15 to 275)	0.01
	Acid Sulphide (Cu, Ni, Pb, Zn)	101	0.01
	Sulphide (Cu) (Non-Acid)	30	0.00
	Refinery (As) Residue	92	0.2
Background	Paleozoic	69	

ARSENIC

ARSENIC LEVELS (ppm) in Vegetation

Vegetation Type	Tailings Type	Average concentration or (range)	Ratio Veg./Tailings
Cattail (leaves)	Gold (Non-Acid)	1.1	0.01
	Uranium (Non-Acid)	(0.2 to 3)	0.0 to 0.2
	(Acid)	3	0.2
	Acid Sulphide (Cu, Ni, Pb, Zn)	-4.1	-0.01
	Sulphide (Cu) (Non-Acid)	0.30	0.00
	Silver (As) (Non-Acid)	(1 to 6.00)	0.00
Background	Paleozoic	0.06	
Horsetail (excluding roots)	Gold (Non-Acid)	(0.10 to 420)	0.01
	Silver (As) (Non-Acid)	176	0.02
	Acid Sulphide (Cu, Pb, Zn, Pt)	(0.11 to 3)	0.00 to 0.01
	Uranium (Non-Acid)	0.40	0.00
	Sulphide (Cu) (Non-Acid)	16	0.08
Background	Paleozoic	0.15	
Birch (leaves)	Gold (Non-Acid)	(0.20 to 480)	0.01
	Uranium (Acid)	0.17	0.00
	(Non-Acid)	0.44	0.00
	Acid Sulphide (Cu, Ni)	0.46	0.01
Background	Paleozoic	0.08	
	Precambrian	0.24	

Poplar (Leaves)	Gold (Non-Acid)	0.3	0.00
	Acid Sulphide (Cu, Pb, Zn, Ni)	(0.07 to 6.3)	0.00 to 0.02
	Silver (As) (Non-Acid)	10.00	0.00
	Uranium (Acid)	-1	=.2?
	(Non-Acid)	(-1 to 3)	0.00 to -0.1
Background	Paleozoic	0.08	
	Precambrian	0.20	
Goldenrod (leaves, stems, flowers)	Gold (Non-Acid)	3.7	0.04
	Uranium (Non-Acid)	(-1 to 5)	-0.00 to 0.3
Tamarack (needles)	Gold (Non-Acid)	16.0	0.00
Basswood (leaves)	Gold (Non-Acid)	0.18	0.00
Aspen (leaves)	Gold (Non-Acid)	0.17	0.00
Background	Paleozoic	0.18	
Oak (leaves)	Smelting & Refining Residue (Co, Ag, As)	10	0.00
Mustard (leaves, stems, flowers)	Acid Sulphide (Cu, Ni)	0.20	0.00
Fleabane (leaves, stems, flowers)	Smelting & Refining Residue (Co, Ag, As)	270	0.01
Background	Paleozoic	0.10	

Vetch (leaves, stems, flowers)	Acid Sulphide (Cu)	-1	-0.00
Background	Paleozoic	0.07	
Maple (leaves)	Sulphide (Cu) (Acid)	20	0.1
	Gold (Non-Acid)	4.60	0.01
	Refinery (As) Residue	20	0.00
Background	Paleozoic	0.06	
	Precambrian	0.12	
Willow (leaves)	Gold (Non-Acid)	0.27	0.00
Background	Paleozoic	0.08	
Purple Clover (leaves, stems, flowers)	Gold (Non-Acid)	0.4	0.00
	Acid Sulphide (Cu, Ni)	0.04	
Background	Paleozoic	0.12	
Sweet Yellow Clover (leaves, flowers, stems)	Gold (Non-Acid)	6	0.1
	Acid Sulphide (Cu, Ni, Pb, Zn)	-1.9	-0.02
	Uranium (Acid)	-1	0.01
Background (sweet white clover)	Paleozoic	0.07	
Evergreen (needles)	Gold (Non-Acid)	3 (spruce)	0.00
		280 (fir)	0.08
		0.60 (pine)	0.00

	Uranium (Non-Acid)	2 (Jack pine)	0.1
Background	Paleozoic	0.03 (pine)	
Trefoil (leaves, flowers, stems)	Uranium (Acid)	(0.08 to 2)	0.00 to 0.1
	Silver (As) (Non-Acid)	(12.4 to 19)	0.00 to 0.3
	Gold (Non-Acid)	0.88	0.00
Background	Paleozoic	0.05	
Grasses (excluding roots)	Uranium (Acid)	0.9	0.01
	(Non-Acid)	(-1 to 2)	-0.1 to 0.1
	Gold (Non-Acid)	2.6	0.03
	Acid Sulphide (Cu, Ni, Pb, Zn)	0.24	0.00
	Sulphide (Cu) (Non-Acid)	3.25	0.02
	Refinery (As) Residue	(90 to 1,500)	0.00 to 0.04
Background	Paleozoic	0.12	

BORON

BORON LEVELS (ppm) in Vegetation

Vegetation Type	Tailings Type	Average concentration or (range)	Ratio Veg./Tailings
Cattail (leaves)	Gold (Non-Acid)	27	0.4
	Uranium (Non-Acid)	20	
	Acid Sulphide (Cu, Ni, Pb, Zn)	23	0.1
	Sulphide (Cu) (Non-Acid)	19	0.2
	Silver (As)	29	0.4
Background	Paleozoic	21.5	
Horsetail (excluding roots)	Gold (Non-Acid)	37	0.5
	Silver (As) (Non-Acid)	36	0.4
	Acid Sulphide (Cu, Pb, Zn, Pt)	21	0.2
	Uranium (Non-Acid)	32	0.4
	Sulphide (Cu) (Non-Acid)	33	0.3
Background	Paleozoic	37	
Birch (leaves)	Gold (Non-Acid)	39	0.5
	Uranium (Acid)	56	0.5
	(Non-Acid)	380	4.5
	Acid Sulphide (Cu, Ni)	60	0.6
Background	Paleozoic	52	
	Precambrian	205	

Poplar (leaves)	Gold (Non-Acid)	51.2	0.7
	Acid Sulphide (Cu, Ni, Pb, Zn)	(27.0 to 47)	0.3 to 0.6
	Silver (As) (Non-Acid)	54	0.7
Background	Paleozoic	58	
	Precambrian	50	
Tamarack (needles)	Gold (Non-Acid)	35	0.7
Basswood (leaves)	Gold (Non-Acid)	52	0.5
Aspen (leaves)	Gold (Non-Acid)	136	1.7
Background	Paleozoic	48	
Oak (leaves)	Smelting & Refining Residue (Co, Ag, As)	205	= 10.3
Mustard (leaves, flowers, stems)	Acid Sulphide (Cu, Ni)	26	0.3
Fleabane (leaves, flowers, stems)	Smelting & Refining Residue (Co, Ag, As)	87	= 4.4
Background	Paleozoic	57	
Vetch (leaves, flowers, stems)			
Background	Paleozoic	42	

Maple (leaves)	Sulphide (Cu) (Non-Acid)	185	1.8
	Gold (Non-Acid)	84	1.4
	Refinery (As) Residue	185	=9.3
Background	Paleozoic	67	
	Precambrian	56	
Willow (leaves)	Gold (Non-Acid)	67	0.7
Background	Paleozoic	66	
Trefoil (Leaves, stems, flowers)	Uranium (Acid)	(32 to 45)	0.3 to = 2.3
	Silver (As) (Non-Acid)	(21 to 24)	0.2 to 0.3
	Gold (Non-Acid)	42.4	0.5
Background	Paleozoic	59	
Purple Clover (leaves, flowers, stems)	Gold (Non-Acid)	33	0.4
	Acid Sulphide (Cu, Ni)	16	
Background	Paleozoic	34	
Yellow Sweet Clover (leaves, stems, flowers)	Gold (Non-Acid)	28	0.28
Background	Paleozoic	27	
Evergreen (needles)	Gold (Non-Acid)	25 (fir)	=1.3
		17 (pine)	0.2
Background	Paleozoic	19 (pine)	

Grasses (excluding roots)	Uranium (Acid)	8.3	= 0.4
	Gold (Non-Acid)	20.4	0.2
	Acid Sulphide (Cu, Ni, Pb, Zn)	16	0.4
	Sulphide (Cu) (Non-Acid)	17	0.2
	Refinery (As) Residue	14	= 0.7
Background	Paleozoic	9	

CADMIUM

CADMIUM LEVELS (ppm) in Vegetation

Vegetation Type	Tailings Type	Average concentration or (range)	Ratio Veg./Tailings
Cattail (Leaves)	Gold (Non-Acid)	-0.08	-0.1
	Uranium (Non-Acid)	(0.08 to -1)	0.08 to -0.5
	(Acid)	-1	-0.5
	Acid Sulphide (Cu, Ni, Pb, Zn)	-0.4	-0.2
	Sulphide (Cu) (Non-Acid)	-0.08	-0.09
	Silver (As) (Non-Acid)	(-0.08 to -1)	-0.07 to -0.5
Background	Paleozoic	-0.08	
Horsetail (excluding roots)	Gold (Non-Acid)	-0.17	-0.1
	Silver (As) (Non-Acid)	-0.08	-0.07
	Acid Sulphide (Cu, Pb, Zn, Pt)	(-0.08 to -1)	-0.3
	Uranium (Non-Acid)	-0.08	-0.08
	Sulphide (Cu) (Non-Acid)	-0.08	-0.01
Background	Paleozoic	0.17	
Birch (Leaves)	Gold (Non-Acid)	-.0.3	-0.2
	Uranium (Acid)	-0.08	-0.27
	(Non-Acid)	0.42	0.42
	Acid Sulphide (Cu, Ni)	0.42	0.1
Background	Paleozoic	0.25	
	Precambrian	0.83	

Poplar (Leaves)	Gold (Non-Acid)	0.6	0.5
	Acid Sulphide (Cu, Pb, Zn, Ni)	(3.17 to 20.0)	1.4 to 1.7
	Silver (As) (Non-Acid)	0.58	0.5
	Uranium		
	(Acid)	-1	= 0.5?
	(Non-Acid)	-1	= 0.5? to -1.0
Background	Paleozoic	0.79	
	Precambrian	1.83	
Golden rod (leaves, stems, flowers)	Gold (Non-Acid)	-1	-2.2
	Uranium (Non-Acid)	(-1 to 2)	-1 to =1
Tamarack (needles)	Gold (Non-Acid)	0.17	0.3
Basswood (leaves)	Gold (Non-Acid)	0.58	1.0
Aspen (leaves)	Gold (Non-Acid)	0.67	1.1
Background	Paleozoic	0.83	
Oak (Leaves)	Smelting and Refining Residue (Co, Ag, As)	-0.08	-0.04
Mustard (leaves, stems, flowers)	Acid Sulphide (Cu, Ni)	-0.08	-0.02
Fleabane (leaves, flowers, stems)	Smelting and Refining Residue (Co, Ag, As)	-0.08	-0.04
Background	Paleozoic	0.42	

Vetch (leaves, stems, flowers)	Sulphide (Cu) (Acid)	-1	-0.5
Background	Paleozoic	0.33	
Maple (leaves)	Sulphide (Cu) (Non-Acid)	-0.08	-0.09
	Gold (Non-Acid)	-0.08	-0.1
	Refinery (As) Residue	-0.08	-0.04
Background	Paleozoic Precambrian	-0.08 0.30	
Willow (leaves)	Gold (Non-Acid)	1	2
Background	Paleozoic	3.17	
Trefoil (leaves, stems, flowers)	Uranium (Acid)	(-0.08 to -1)	= 0.1 to -0.5
	Silver (As) (Non-Acid)	-0.08	-0.07 to -0.1
	Gold (Non-Acid)	-0.11	-0.2
Background	Paleozic	0.08	
Purple Clover (leaves, stems, flowers)	Gold (Non-Acid)	-1.1	-0.4
	Acid Sulphide (Cu, Ni)	-0.08	
Background	Paleozoic	-0.4	
Sweet Yellow Clover (leaves, stems, flowers)	Gold (Non-Acid)	-1	-3.3
	Acid Sulphide (Cu, Ni, Pb, Zn)	-0.7	-1.3

	Uranium (Acid)	-1	-3.3
Background	Paleozoic	-0.08	
Evergreen (needles)	Gold (Non-Acid)	-1 (spruce) -0.08 (fir) 0.17 (pine)	-0.5 -0.04 0.02
	Uranium (Non-Acid)	-1 (Jack pine)	-0.5
Background	Paleozoic	-0.08	
Grasses (excluding roots)	Uranium (Acid)	-0.4	-0.2
	(Non-Acid)	-1	-0.5
	Gold (Non-Acid)	-0.5	-1.2
	Acid Sulphide (Cu, Ni, Pb, Zn)	-2.3	-0.7
	Sulphide (Cu) (Non-Acid)	0.33	0.4
	Refinery (As) Residue	(0.08 to -1)	= 0.04 to -0.5
Background	Paleozoic	-0.08	

CALCIUM

CALCIUM LEVELS (ppm) in Vegetation

Vegetation Type	Tailings Type	Average concentration or (range)	Ratio Veg./Tailings
Cattail (leaves)	Gold (Non-Acid)	10,438	4.3
	Uranium (Non-Acid)	(9,400 to 15,400)	0.6 to 25
	Uranium (Acid)	24,400	0.8
	Sulphide (Acid) (Cu, Ni, Pb, Zn)	10,025	3.9
	Sulphide (Non-Acid)	11,600	2.8
	Silver (arsenic)	(8,700 to 18,500)	1.8 to 4.4
Background	(Paleozoic)	15,000	
Horsetail (excluding roots)	Gold (Non-Acid)	27,133	13
	Silver (arsenic) (Non-Acid)	17,433	3.5
	Acid Sulphides (Cu, Ni, Pb, Zn)	(25,300 to 31,500)	11 to 14.3
	Uranium (Non-Acid)	38,000	102
	Copper Sulphide (Non-Acid)	34,000	8.3
Background	Paleozoic	38,500	
Birch (leaves)	Gold (Non-Acid)	15,400	3.9
	Uranium (Non-Acid)	22,200	59
	Uranium (Acid)	11,000	112

	Acid Sulphide (Cu, Ni)	12,400	3.3
Background	Paleozoic	15,300	
	Precambrian	15,000	
Poplar (leaves)	Gold (Non-Acid)	12,413	5.9
	Acid Sulphide (Cu, Ni, Pb, Zn)	(18,400 to 23,400)	4.9 to 9.9
	Silver (Non-Acid)	17,700	3.6
	Uranium (Acid)	24,000	12.6
	Uranium (Non-Acid)	23,500	0.9 to 62.8
Background	Paleozoic	20,100	
	Precambrian	28,000	
Golden rod (leaves, flowers, stems)	Gold (Non-Acid)	17,567	7.5
	Uranium (Non-Acid)	(16,700 to 20,000)	1.4 to 53
Tamarack (needles)	Gold (Non-Acid)	4,000	1.5
Basswood (leaves)	Gold (Non-Acid)	30,000	7.8
Aspen (leaves)	Gold (Non-Acid)	15,650	4.9
Background	Paleozoic	13,300	
Oak (leaves)	Smelting and Refining Residue (Co, Ag, As)	11,000	0.3

Mustard (leaves, flowers, stems)	Acid Sulphide (Cu, Ni)	4,100	1.1
Fleabane (leaves, flowers, stems)	Smelting and Refining Residue (Co, Ag, As)	15,000	0.4
Background	Paleozoic	11,900	
Vetch (leaves, flowers, stems)	Acid Sulphide (Cu)	48,000	3.4
Background	Paleozoic	19,300	
Maple (leaves)	Sulphide (Cu) (Non-Acid)	37,000	9.1
	Gold (Non-Acid)	21,400	8.4
	Refinery Residue (As)	37,000	1
Background	Paleozoic	23,400	
	Precambrian	16,000	
Willow (leaves)	Gold (Non-Acid)	12,733	=2.6?
Background	Paleozoic	21,400	
Trefoil (leaves, flowers, stems)	Uranium (Acid)	(11,900 to 26,500)	1.7 to 128
	Silver (with As)	(14,100 to 15,600)	2.8 to 5.1
	Gold (Non-Acid)	16,690	2.8
Background	Paleozoic	22,200	

Purple Clover (leaves, flowers, stems)	Gold (Non-Acid)	13,400	1.9 to 21
	Acid Sulphide (Cu, Ni)	10,300	
Background	Paleozoic	24,600	
Yellow Sweet Clover	Gold (Non-Acid)	25,000	10
	Acid Sulphides (Cu, Ni, Pb, Zn)	19,900	3.2
	Uranium (Acid)	24,000	245
Background (sweet white clover)	Paleozoic	14,400	
Fir (Needles)	Gold (Non-Acid)	5,600	0.4
Spruce (Needles)	Gold (Non-Acid)	22,800	2.5
Pine (Needles)	Gold (Non-Acid)	3,600	0.9
Jack Pine (Needles)	Uranium (Non-Acid)	17,400	0.7
Background Pine needles	Paleozoic	3,000	
Grasses (excluding roots)	Uranium (Acid)	7,100	1.7
	Uranium (Non-Acid)	(12,700 to 13,000)	0.5 to 1.1
	Gold (Non-Acid)	6,189	2.5
	Acid Sulphides (Cu, Ni, Pb, Zn)	6,375	2.0

	Sulphide (Cu) (Non-Acid)	6,600	1.6
	Refinery Residue (As)	(3,400 to 9,600)	0.09 to 0.3
Background	Paleozoic	7,700	

CHROMIUM

CHROMIUM LEVELS (ppm) in Vegetation

Vegetation Type	Tailings Type	Average concentration or (range)	Ratio Veg./Tailings
Cattail (leaves)	Gold (Non-Acid)	1	0.01
	Uranium (Non-Acid)	(0.74 to -5)	0.01 to -0.2
	(Acid)	-5	-0.2
	Acid Sulphide (Cu, Ni, Pb, Zn)	-3.1	-0.01
	Sulphide (Cu) (Non-Acid)	1.32	0.01
	Silver (As) (Non-Acid)	(1.17 to -5)	0.00 to -0.01
Background	Paleozoic	0.74	
Horsetail (excluding roots)	Gold (Non-Acid)	1.29	0.01
	Silver (As) (Non-Acid)	1	0.00
	Acid Sulphide (Cu, Pb, Zn, Pt)	(1.03 to 5)	0.01
	Uranium (Non-Acid)	1.18	0.01
	Sulphide (Cu) (Non-Acid)	1.76	0.02
Background	Paleozoic	1.18	
Birch (leaves)	Gold (Non-Acid)	0.9	0.01
	Uranium (Acid)	1.18	0.06
	(Non-Acid)	0.88	0.01
	Acid Sulphide (Cu, Ni)	1.76	0.01
Background	Paleozoic	0.88	
	Precambrian	1.18	

Poplar (leaves)	Gold (Non-Acid)	1.2	0.01
	Acid Sulphide (Cu, Pb, Zn, Ni)	(1.03 to 2.06)	0.01
	Silver (As) (Non-Acid)	0.59	0.00
	Uranium (Acid)	-5	-0.4
		-5	-0.06 to -0.2
Background	Paleozoic	0.78	
	Precambrian	1.17	
Golden rod (leaves, stems, flowers)	Gold (Non-Acid)	-5	-0.04
	Uranium (Non-Acid)	-5	-0.07 to -0.4
Tamarack (needles)	Gold (Non-Acid)	1.18	0.02
Basswood (leaves)	Gold (Non-Acid)	1.47	0.01
Aspen (leaves)	Gold (Non-Acid)	1.33	0.01
Background	Paleozoic	0.82	
Oak (leaves)	Smelting & Refining Residue (Co, Ag, As)	0.74	0.00
Mustard (leaves, stems, flowers)	Acid Sulphide (Cu, Ni)	2.21	0.01
Fleabane (leaves, flowers, stems)	Smelting & Refining Residue (Co, Ag, As)	1.18	0.01
Background	Paleozoic	0.78	

Vetch (leaves, flowers, stems)	Acid Sulphide (Cu)	-5	-0.2
Background	Paleozoic	0.74	
Maple (leaves)	Sulphide (Cu) (Non-Acid)	0.88	0.01
	Gold (Non-Acid)	0.60	0.01
	Refinery (As) Residue	0.88	0.00
Background	Paleozoic	0.74	
	Precambrian	0.88	
Willow (leaves)	Gold (Non-Acid)	0.74	0.01
Background	Paleozoic	0.94	
Trefoil (leaves, stems, flowers)	Uranium (Acid)	(1.03 to -5)	0.05 to 0.1
	Silver (As) (Non-Acid)	(1.18 to 1.47)	0.00 to 0.01
	Gold (Non-Acid)	1.23	0.01
Background	Paleozoic	1.03	
Purple Clover (leaves, stems, flowers)	Gold (Non-Acid)	1.08	0.02
	Acid Sulphide (Cu, Ni)	1.03	
Background	Paleozoic	0.81	
Yellow Sweet Clover (leaves, stems, flowers)	Gold (Non-Acid)	-5	-0.1

	Acid Sulphide (Cu, Ni, Pb, Zn)	-3.8	-0.1
	Uranium (Acid)	-5	-0.3
Background (white sweet clover)	Paleozoic	0.59	
Evergreen (needles)	Gold (Non-Acid)	-5 (spruce)	-0.1
		0.70 (fir)	0.02
		0.59 (pine)	0.01
	Uranium (Non-Acid)	-5 (Jack pine)	-0.2
Background	Paleozoic	0.56 (pine)	
Grasses (excluding roots)	Uranium (Acid)	(0.74 to -5)	-0.3
	(Non-Acid)	-5	-0.2 to -0.4
	Gold (Non-Acid)	1.2	-0.03
	Acid Sulphide (Cu, Ni, Pb, Zn)	5.22	0.03
	Sulphide (Cu) (Non-Acid)	1.76	0.02
	Refinery (As) Residue	(1.32 to -5)	0.01 to - 0.03
Background	Paleozoic	0.86	

COBALT

COBALT LEVELS (ppm) in Vegetation

Vegetation Type	Tailings Type	Average concentration or (range)	Ratio Veg./Tailings
Cattail (leaves)	Gold (Non-Acid)	0.7	0.02
	Uranium (Acid)	-2	-0.1
	(Non-Acid)	(0.92 to -2)	0.05 to -0.09
	Acid Sulphide (Cu, Ni, Pb, Zn)	-1.0	-0.01
	Sulphide (Cu) (Non-Acid)	0.83	0.02
	Silver (As) (Non-Acid)	(-2 to 2.83)	-0.01 to 0.01
Background	Paleozoic	-0.47	
Horsetail (excluding roots)	Gold (Non-Acid)	2.02	0.07
	Silver (As) (Non-Acid)	24	0.07
	Acid Sulphide (Cu, Pb, Zn, Pt)	(1.58 to -2)	-0.01 to 0.01
	Uranium (Non-Acid)	1.17	0.07
	Sulphide (Cu) (Non-Acid)	4.25	0.08
Background	Paleozoic	0.71	
Birch (leaves)	Gold (Non-Acid)	1.2	0.2
	Uranium (Acid)	4.60	=4.6
	(Non-Acid)	2.67	0.16
	Acid Sulphide (Cu, Ni)	2.67	0.02
Background	Paleozoic	0.73	
	Precambrian	1.33	

Poplar (leaves)	Gold (Non-Acid)	6	0.21
	Acid Sulphide (Cu, Ni, Pb, Zn)	(3.83 to 11.46)	0.02 to 0.2
	Silver (As) (Non-Acid)	1,770	4.9
	Uranium		
	(Acid)	-2	-0.3
	(Non-Acid)	-2	-0.09 to -0.1
Background	Paleozoic	0.71	
	Precambrian	1.83	
Goldenrod (leaves, stems, flowers)	Gold (Non-Acid)	-2	-0.1
	Uranium (Non-Acid)	-2	-0.1 to 0.2
Tamarack (needles)	Gold (Non-Acid)	0.58	0.01
Basswood (leaves)	Gold (Non-Acid)	3.67	0.1
Aspen (leaves)	Gold (Non-Acid)	6.71	0.4
Background	Paleozoic	0.75	
Oak (leaves)	Smelting & Refining Residue (Co, Ag, As)	1.83	0.00
Mustard (leaves, flowers, stems)	Acid Sulphide (Cu, Ni)	3.33	0.02
Fleabane (leaves, stems, flowers)	Smelting & Refining Residue (Co, Ag, As)	8.34	0.00
Background	Paleozoic	0.64	

Vetch (leaves, flowers, stems)	Acid Sulphide (Cu)	-2	-0.2
Background	Paleozoic	0.67	
Maple (leaves)	Sulphide (Cu) (Non-Acid)	3.50	0.06
	Gold (Non-Acid)	0.58	0.02
	Refinery (As) Residue	3.50	0.00
Background	Paleozoic Precambrian	0.79 0.60	
Willow (leaves)	Gold (Non-Acid)	1.7	0.1
Background	Paleozoic	2.25	
Trefoil (leaves, flowers, stems)	Uranium (Acid)	(0.75 to -2)	0.02 to =1.4
	Silver (As) (Non-Acid)	(7.75 to 8.25)	0.02 to 0.1
	Gold (Non-Acid)	1.77	0.07
Background	Paleozoic	0.99	
Purple Clover (leaves, flowers, stems)	Gold (Non-Acid)	1.7	0.04
	Acid Sulphide (Cu, Ni)	1.08	
Background	Paleozoic	0.52	
Yellow Sweet Clover (leaves, stems, flowers)	Gold (Non-Acid)	-2	-0.1
	Acid Sulphide (Cu, Ni, Pb, Zn)	-1.8	-0.3

	Uranium (Acid)	-2	-2
Background	Paleozoic	0.88	
Evergreen (needles)	Gold (Non-Acid)	-2 (spruce) 0.49 (fir) 0.50 (pine)	-0.2 0.04 0.02
	Uranium (Non-Acid)	-2 (Jack pine)	-0.09
Background	Paleozoic	0.42 (pine)	
Grasses (excluding roots)	Uranium (Acid)	-1.3	-0.1
	(Non-Acid)	-2	-0.09 to -0.2
	Gold (Non-Acid)	-1.5	-0.1
	Acid Sulphide (Cu, Ni, Pb, Zn)	3.6	0.04
	Sulphide (Cu) (Non-Acid)	225	4.2
	Refinery (As) Residue	(19 to 22.72)	0.01
Background	Paleozoic	0.76	

COPPER

COPPER LEVELS (ppm) in Vegetation

Vegetation Type	Tailings Type	Average concentration or (range)	Ratio Veg./Tailings
Cattail (leaves)	Gold (Non-Acid)	5.7	0.07
	Uranium		
	(Acid)	8	0.2
	(Non-Acid)	(8 to 9.3)	0.2
	Acid Sulphide (Cu, Ni, Pb, Zn)	12.7	0.01
	Sulphide (Cu) (Non-Acid)	9.3	0.02
	Silver (As) (Non-Acid)	(3.7 to 15)	0.03 to 0.09
Background	Paleozoic	7.0	
Horsetail (excluding roots)	Gold (Non-Acid)	5.8	0.1
	Silver (As) (Non-Acid)	4.4	0.04
	Acid Sulphide (Cu, Pb, Zn, Pt)	(13.1 to 27)	0.01
	Uranium (Non-Acid)	5.2	0.13
	Sulphide (Cu) (Non-Acid)	27	0.1
Background	Paleozoic	8.5	
Birch (leaves)	Gold (Non-Acid)	11	0.1
	Uranium		
	(Acid)	13.2	0.3
	(Non-Acid)	7.0	0.2
	Acid Sulphide (Cu, Ni)	13	0.03
Background	Paleozoic	7.4	
	Precambrian	7.1	

Poplar (leaves)	Gold (Non-Acid)	7.9	0.10
	Acid Sulphide (Cu, Pb, Zn, Ni)	(13.9 to 33.3)	0.01 to 0.05
	Silver (As) (Non-Acid)	6.0	0.05
	Uranium (Acid)	12	0.7
	(Non-Acid)	(6 to 12)	0.2
Background	Paleozoic	8.4	
	Precambrian	8.4	
Goldenrod (leaves, stems, flowers)	Gold (Non-Acid)	10.3	0.2
	Uranium (Non-Acid)	(10 to 12)	0.3 to 0.6
Tamarack (needles)	Gold (Non-Acid)	6.5	0.2
Basswood (leaves)	Gold (Non-Acid)	9.5	0.1
Aspen (leaves)	Gold (Non-Acid)	9.9	0.2
Background	Paleozoic	9.3	
Oak (leaves)	Smelting and Refining Residue (Co, Ag, As)	6.2	0.00
Mustard (leaves, stems, flowers)	Acid Sulphide (Cu, Ni)	13.3	0.03
Fleabane (stems, leaves, flowers)	Smelting and Refining Residue (Co, Ag, As)	31	0.00
Background	Paleozoic	21	

Vetch (leaves, flowers, stems)	Acid Sulphide (Cu)	12	0.2
Background	Paleozoic	9.2	
Maple (leaves)	Sulphide (Cu) (Non-Acid)	6.3	0.01
	Gold (Non-Acid)	7.5	0.1
	Refinery (As) Residue	6.3	0.00
Background	Paleozoic	8.2	
	Precambrian	3.9	
Willow (leaves)	Gold (Non-Acid)	8.3	0.1
Background	Paleozoic	8.9	
Trefoil (leaves, stems, flowers)	Uranium (Acid)	(9 to 40)	0.3 to 1.03
	Silver (As) (Non-Acid)	(8.4 to 12.3)	0.08 to 0.3
	Gold (Non-Acid)	7.9	0.06
Background	Paleozoic	14.7	
Purple Clover (leaves, stems, flowers)	Gold (Non-Acid)	12.1	0.1
	Acid Sulphide (Cu, Ni)	20.0	
Background	Paleozoic	13.6	
Yellow Sweet Clover (leaves, stems, flowers)	Gold (Non-Acid)	7	0.2
	Acid Sulphide (Cu, Ni, Pb, Zn)	(13 to 89)	0.07

	Uranium (Acid)	21	0.5
Background (white sweet clover)	Paleozoic	9.5	
Evergreen (needles)	Gold (Non-Acid)	2 (spruce)	0.06
		6.00 (fir)	0.08
		4.10 (pine)	0.04
	Uranium (Non-Acid)	6 (Jack Pine)	0.1
Background	Paleozoic	4.8 (pine)	
Grasses (excluding roots)	Uranium (Acid)	8	0.4
	(Non-Acid)	(10 to 12)	0.2 to 0.7
	Gold (Non-Acid)	5.2	0.07
	Acid Sulphide (Cu, Ni, Pb, Zn)	51	0.09
	Sulphide (Cu) (Non-Acid)	44	0.08
	Refinery (As) Residue	(16.5 to 22)	0.00
Background	Paleozoic	7	

IRON

IRON LEVELS (ppm) in Vegetation

Vegetation Type	Tailings Type	Average concentration or (range)	Ratio Veg./Tailings
Cattail (leaves)	Gold (Non-Acid)	53	0.00
	Uranium		
	(Acid)	110	0.00
	(Non-Acid)	(40 to 90)	0.00
	Acid Sulphide (Cu, Ni, Pb, Zn)	355	0.00
	Sulphide (Cu) (Non-Acid)	260	0.01
	Silver (As) (Non-Acid)	(40 to 310)	0.00 to 0.01
Background	Paleozoic	60	
Horsetail (excluding roots)	Gold (Non-Acid)	709	0.01
	Silver (As) (Non-Acid)	90	0.00
	Acid Sulphide (Cu, Pb, Zn, Pt)	(300 to 700)	0.00 to 0.01
	Uranium (Non-Acid)	190	0.00
	Sulphide (Cu) (Non-Acid)	780	0.02
Background	Paleozoic	80	
Birch (leaves)	Gold (Non-Acid)	222	0.00
	Uranium		
	(Acid)	120	0.01
	(Non-Acid)	65	0.00
	Acid Sulphide (Cu, Ni)	180	0.00
Background	Paleozoic	80	
	Precambrian	200	

Poplar (leaves)	Gold (Non-Acid)	93	0.00
	Acid Sulphide (Cu, Ni, Pb, Zn)	(190 to 730)	0.00 to 0.01
	Silver (As) (Non-Acid)	80	0.00
	Uranium (Acid) (Non-Acid)	 180 (50 to 160)	 0.04 0.00 to 0.01
Background	Paleozoic Precambrian	53 80	
Goldenrod (leaves, stems, flowers)	Gold (Non-Acid)	210	0.01
	Uranium (Non-Acid)	(120 to 230)	0.00 to 0.01
Tamarack (needles)	Gold (Non-Acid)	220	0.00
Basswood (leaves)	Gold (Non-Acid)	420	0.01
Aspen (leaves)	Gold (Non-Acid)	100	0.00
Background	Paleozoic	70	
Oak (leaves)	Smelting and Refining (As) Residue	60	0.00
Mustard (leaves, stems, flowers)	Acid Sulphide (Cu, Ni)	880	0.00
Fleabane (leaves, stems, flowers)	Smelting and Refining Residue (Co, Ag, As)	240	0.00
Background	Paleozoic	70	

Vetch (leaves, stems, flowers)	Acid Sulphide (Cu)	170	0.00
Background	Paleozoic	80	
Maple (leaves)	Sulphide (Cu) (Non-Acid)	180	0.00
	Gold (Non-Acid)	80	0.00
	Refinery (As) Residue	180	0.00
Background	Paleozoic	60	
	Precambrian	70	
Willow (leaves)	Gold (Non-Acid)	67	0.00
Background	Paleozoic	80	
Trefoil (leaves, stems, flowers)	Uranium (Acid)	(60 to 190)	0.00 to 0.01
	Silver (As) (Non-Acid)	180	0.00
	Gold (Non-Acid)	153	0.00
Background	Paleozoic	160	
Purple Clover (leaves, stems, flowers)	Gold (Non-Acid)	(70 to 1,380)	0.00
	Acid Sulphide (Cu, Ni)	8.5	
Background	Paleozoic	145	
Sweet Yellow Clover	Gold (Non-Acid)	320	0.02
	Acid Sulphide (Cu, Ni, Pb, Zn)	517	0.01

	Uranium (Acid)	150	0.01
Background	Paleozoic	80	
Evergreen (needles)	Gold (Non-Acid)	50 (spruce)	0.00
		715 (fir)	0.00
		180 (pine)	0.00
	Uranium (Non-Acid)	90 (pine)	0.00
Background	Paleozoic	40 (pine)	
Grasses (excluding roots)	Uranium (Acid)	68	0.01
	(Non-Acid)	(290 to 320)	0.01 to 0.02
	Gold (Non-Acid)	92	0.00
	Acid Sulphide (Cu, Ni, Pb, Zn)	449	0.00
	Sulphide (Cu) (Non-Acid)	900	0.02
	Refinery (As) Residue	(540 to 900)	0.01
Background	Paleozoic	120	

LEAD

LEAD LEVELS (ppm) in Vegetation

Vegetation Type	Tailings Type	Average concentration or (range)	Ratio Veg./Tailings
Cattail (leaves)	Gold (Non-Acid)	2.5	0.1
	Uranium (Non-Acid)	(1.88 to 2)	0.01 to 0.02
	(Acid)	14	0.02
	Acid Sulphide (Cu, Ni, Pb, Zn)	5.4	0.1
	Sulphide (Cu) (Non-Acid)	2.5	0.06
	Silver (As) (Non-Acid)	(1.00 to 16)	0.04 to 0.5
Background	Paleozoic	3.28	
Horsetail (excluding roots)	Gold (Non-Acid)	3.00	0.24
	Silver (As) (Non-Acid)	1.3	0.05
	Acid Sulphide (Cu, Pb, Zn, Pt)	(4.38 to 8)	0.00 to 0.2
	Uranium (Non-Acid)	8.75	0.08
	Sulphide (Cu) (Non-Acid)	3.44	0.08
Background	Paleozoic	3.58	
Birch (leaves)	Gold (non-Acid)	5.0	0.1
	Uranium (Acid)	4.38	0.19
	(Non-Acid)	11.25	0.10
	Acid Sulphide (Cu, Ni)	1.88	0.21
Background	Paleozoic	13.13	
	Precambrian	8.13	

Poplar (leaves)	Gold (Non-Acid)	4.2	0.2
	Acid Sulphide (Cu, Pb, Zn, Ni)	(3.75 to 9.38)	0.00 to 0.41
	Silver (As) (Non-Acid)	1.88	0.07
	Uranium (Acid)	15	0.1
	(Non-Acid)	(15 to 20)	0.2 to 0.08
Background	Paleozoic	5.16	
	Precambrian	4.38	
Goldenrod (leaves, stems, flowers)	Gold (Non-Acid)	5.3	0.2
	Uranium (non-Acid)	(10 to 12)	0.09 to 0.2
Tamarack (needles)	Gold (Non-Acid)	5.00	= 5
Basswood (leaves)	Gold (Non-Acid)	6.25	0.7
Aspen (leaves)	Gold (Non-Acid)	4.38	0.4
Background	Paleozoic	5.63	
Oak (leaves)	Smelting and Refining Residue (Cu, Ag, As)	1.25	0.02
Mustard (leaves, stems, flowers)	Acid Sulphide (Cu, Ni)	2.50	0.3
Fleabane (leaves, stems, flowers)	Smelting and Refining Residue (Co, Ag, As)	3.75	0.06
Background	Paleozoic	6.88	

Vetch (leaves, stems, flowers)	Acid Sulphide (Cu)	19	0.07
Background	Paleozoic	7.50	
Maple (leaves)	Sulphide (Cu) (Non-Acid)	4.06	0.09
	Gold (Non-Acid)	4.38	0.5
	Refinery (As) Residue	4.06	0.06
Background	Paleozoic Precambrian	3.29 2.50	
Willow (leaves)	Gold (Non-Acid)	4	0.3
Background	Paleozoic	7.50	
Trefoil (leaves, stems, flowers)	Uranium (Acid)	(1.87 to 4)	0.01 to 0.08
	Silver (As) (Non-Acid)	(1.88 to 3.44)	0.07 to 0.3
	Gold (Non-Acid)	2.61	0.1
Background	Paleozoic	5.00	
Purple Clover (leaves, stems, flowers)	Gold (Non-Acid)	2.8	0.1
	Acid Sulphide (Cu, Ni)	2.50	
Background	Paleozoic	5.9	
Yellow Sweet Clover (leaves, stems, flowers)	Gold (Non-Acid)	10	0.6
	Acid Sulphide (Cu, Ni, Pb, Zn)	14	0.4
	Uranium (Acid)	7	0.3

Background (white sweet clover)	Paleozoic	2.50	
Evergreen (needles)	Gold (Non-Acid)	6 (spruce)	0.1
		3.30 (fir)	0.01
		7.50 (pine)	0.1
	Uranium (Non-Acid)	5 (Jack Pine)	0.03
Background	Paleozoic	2.50 (pine)	
Grasses (excluding roots)	Uranium (Acid)	1.9	0.05
	(Non-Acid)	(9 to 13)	0.05 to 0.2
	Gold (Non-Acid)	2.0	0.1
	Acid Sulphide (Cu, Ni, Pb, Zn)	6.2	0.08
	Sulphide (Cu) (Non-Acid)	3.13	0.07
	Refinery (As) Residue	(-2 to 6.25)	-0.03 to 0.09
Background	Paleozoic	3.96	

MAGNESIUM

MAGNESIUM LEVELS (ppm) in Vegetation

Vegetation Type	Tailings Type	Average concentration or (range)	Ratio Veg./Tailings
Cattail (leaves)	Gold (Non-Acid)	2,375	1.0
	Uranium (Non-Acid)	(900 to 3,600)	0.1 to 2.1
	Uranium (Acid)	1,200	7.1
	Sulphide (Acid) (Cu, Ni, Pb, Zn)	1,875	0.1
	Sulphide (Cu) (Non-Acid)	1,200	4.0
	Silver (arsenic)	(1,000 to 5,200)	0.1 to 0.4
Background	Paleozoic	1,800	
Horsetail (excluding roots)	Gold (Non-Acid)	8,327	1.9
	Silver (As) (Non-Acid)	1,600	0.2
	Acid Sulphides (Cu, Ni, Pb, Zn)	(1,400 to 10,400)	0.2 to 0.4
	Uranium (Non-Acid)	4,600	0.6
	Sulphide (Cu) (Non-Acid)	2,900	9.6
Background	Paleozoic	7,500	
Birch (leaves)	Gold (Non-Acid)	7,114	1.4
	Uranium (Acid)	1,800	2.3
	Uranium (Non-Acid)	5,700	0.8

	Acid Sulphide (Cu, Ni)	2,900	0.3
Background	Paleozoic Precambrian	4,500 4,200	
Poplar (leaves)	Gold (Non-Acid)	6,760	1.3
	Acid Sulphide (Cu, Ni, Pb, Zn)	(2,500 to 2,900)	0.4
	Silver (Non-Acid)	1,400	0.1
	Uranium (Acid)	2,700	19
	Uranium (Non-Acid)	(2,000 to 3,500)	0.3 to 2.1
Background	Paleozoic Precambrian	4,200 4,500	
Goldenrod (leaves, stems, flowers)	Gold (Non-Acid)	3,967	0.8
	Uranium (Non-Acid)	(2,000 to 4,900)	0.7 to 1.7
Tamarack (needles)	Gold (Non-Acid)	3,200	0.8
Basswood (leaves)	Gold (Non-Acid)	6,800	0.8
Aspen (leaves)	Gold (Non-Acid)	9,150	1.3
Background	Paleozoic	5,100	
Oak (leaves)	Smelting and Refining Residue (Co, Ag, As)	1,000	33.3

Mustard (leaves, stems, flowers)	Acid Sulphide (Cu, Ni)	1,800	0.2
Fleabane (leaves, stems, flowers)	Smelting and Refining Residue (Co, Ag, As)	4,300	143
Background	Paleozoic	3,500	
Vetch (leaves, stems, flowers)	Acid Sulphide (Cu)	9,500	3.9
Background	Paleozoic	2,800	
Maple (leaves)	Sulphide (Non-Acid)	2,800	9.3
	Gold (Non-Acid)	4,600	1
	Refinery (As) Residue	2,800	93
Background	Paleozoic Precambrian	2,900 1,800	
Willow (leaves)	Gold (Non-Acid)	5,733	1.1
Background	Paleozoic	5,900	
Trefoil (leaves, stems, flowers)	Uranium (Acid)	(1,100 to 4,600)	1.4 to 28
	Silver (As)	(2,750 to 3,700)	0.3 to 0.6
	Gold (Non-Acid)	6,580	0.7
Background	Paleozoic	2,800	
Purple Clover (leaves, stems, flowers)	Gold (Non-Acid)	4,367	0.4

	Acid Sulphide (Cu, Ni)	2,000	
Background	Paleozoic	5,300	
Sweet Yellow Clover (leaves, stems, flowers)	Gold (Non-Acid)	2,900	0.6
	Acid Sulphide (Cu, Ni, Pb, Zn)	3,167	0.9
	Uranium (Acid)	6,500	8.3
Background (sweet white clover)	Paleozoic	2,800	
Evergreen (needles)	Gold (Non-Acid)	1,600 (spruce)	2.7
		2,700 (fir)	1
		1,900 (pine)	0.2
	Uranium (Non-Acid)	1,900 (Jack Pine)	1.1
Background	Paleozoic	1,800 (Pine)	
Grasses (excluding roots)	Uranium (Acid)	2,380	11.5
	Uranium (Non-Acid)	(1,300 to 1,700)	1.1
	Gold (Non-Acid)	1,756	0.4
	Acid Sulphide (Cu, Ni, Pb, Zn)	3,956	0.4
	Sulphide (Cu) (Non-Acid)	1,500	5.0
	Refinery Residue (As)	(800 to 1,600)	26.7 to 53
Background	Paleozoic	3,400	

MANGANESE

MANGANESE LEVELS (ppm) in Vegetation

Vegetation Type	Tailings Type	Average concentration or (range)	Ratio Veg./Tailings
Cattail (leaves)	Gold (Non-Acid)	784	= 5.4
	Uranium (Non-Acid)	(612 to 1,550)	0.6 to 1.8
	(Acid)	400	40
	Acid Sulphide (Cu, Ni, Pb, Zn)	(-5 to 1,248)	-2.7
	Sulphide (Cu) (Non-Acid)	530	1.3
	Silver (As) (Non-Acid)	(50 to 435)	0.1 to 0.4
Background	Paleozoic	552	
Horsetail (excluding roots)	Gold (Non-Acid)	180	0.5
	Silver (As) (Non-Acid)	94	0.09
	Acid Sulphide (Cu, Pb, Zn, Pt)	50 to 75	0.2 to 0.4
	Uranium (Non-Acid)	90	0.09
	Sulphide (Cu) (Non-Acid)	108	0.3
Background	Paleozoic	130	
Birch (leaves)	Gold (Non-Acid)	371	0.8
	Uranium (Acid)	45	= 4.5
	(Non-Acid)	885	0.9
	Acid Sulphide (Cu, Ni)	1,229	2.2
Background	Paleozoic	110	
	Precambrian	870	

Poplar (leaves)	Gold (Non-Acid)	170	0.4
	Acid Sulphide (Cu, Ni, Pb, Zn)	(171 to 525)	0.2 to 2.8
	Silver (As) (Non-Acid)	38	0.04
	Uranium (Acid)	5	1
	(Non-Acid)	(100 to 400)	0.1 to 0.5
Background	Paleozoic	69	
	Precambrian	177	
Goldenrod (leaves, stems, flowers)	Gold (Non-Acid)	(-50 to 1,400)	
	Uranium (Non-Acid)	(200 to 850)	0.2 to 2.8
Tamarack (needles)	Gold (Non-Acid)	833	0.9
Basswood (leaves)	Gold (Non-Acid)	288	0.5
Aspen (leaves)	Gold (Non-Acid)	252	0.5
Background	Paleozoic	123	
Oak (leaves)	Smelting and Refining Residue (Co, Ag, As)	1,035	24.6
Mustard (leaves, stems, flowers)	Acid Sulphide (Cu, Ni)	563	1.0
Fleabane (leaves, stems, flowers)	Smelting and Refining Residue (Co, Ag, As)	144	3.4
Background	Paleozoic	109	

Vetch (leaves, stems, flowers)	Acid Sulphide (Cu)	-50	-0.04
Background	Paleozoic	90	
Maple (leaves)	Sulphide (Cu) (Non-Acid)	51	0.1
	Gold (Non-Acid)	158	0.3
	Refinery (As) Residue	51	1.2
Background	Paleozoic Precambrian	126 570	
Willow (leaves)	Gold (Non-Acid)	879	1.7
Background	Paleozoic	322	
Trefoil (leaves, stems, flowers)	Uranium (Acid)	(41 to 698)	= 4.1 to 69.8
	Silver (As) (Non-Acid)	(51 to 53)	0.05 to 0.1
	Gold (Non-Acid)	121	0.4
Background	Paleozoic	113	
Purple Clover (leaves, stems, flowers)	Gold (Non-Acid)	74	0.5
	Acid Sulphide (Cu, Ni)	78	
Background	Paleozoic	57	
Yellow Sweet Clover (leaves, stems, flowers)	Gold (Non-Acid)	-50	-0.5
	Acid Sulphide (Cu, Ni, Pb, Zn)	(-5 to 50)	-0.07

	Uranium (Acid)	-50	= 5.0
Background	Paleozoic	28	
Evergreen (needles)	Gold (Non-Acid)	100 (spruce) 73 (fir) 144 (pine)	0.3 0.05 0.1
	Uranium (Non-Acid)	550	0.7
Background	Paleozoic	30 (pine)	
Grasses (excluding roots)	Uranium (Acid)	(24.9 to 400)	7.7
	(Non-Acid)	(800 to 950)	0.9 to 3.1
	Gold (Non-Acid)	217	0.4
	Acid Sulphide (Cu, Ni, Pb, Zn)	229	0.8
	Sulphide (Cu) (Non-Acid)	285	0.7
	Refinery (As) Residue	(-50 to 198)	-1.2 to 4.7
Background	Paleozoic	320	

MERCURY

MERCURY LEVELS (ppm) in Vegetation

Vegetation Type	Tailings Type	Average concentration or (range)	Ratio Veg./Tailings
Cattail (leaves)	Gold (Non-Acid)	-0.049	-0.131
	Uranium (Non-Acid)	0.055	1.038
	Acid Sulphide (Cu, Ni, Pb, Zn)	0.037	0.096
	Sulphide (Cu) (Non-Acid)	0.062	1.348
	Silver (As) (Non-Acid)	0.036	0.037
Background	Paleozoic	0.069	
Horsetail (excluding roots)	Gold (Non-Acid)	-0.042	-0.14
	Silver (As) (Non-Acid)	0.064	0.066
	Acid Sulphide (Cu, Pb, Zn, Pt)	-0.025	-0.088
	Uranium (Non-Acid)	0.045	0.849
	Sulphide (Cu) (Non-Acid)	0.073	1.587
Background	Paleozoic	0.082	
Birch (leaves)	Gold (Non-Acid)	0.098	0.251
	Uranium (Acid)	0.055	0.9
	(Non-Acid)	0.076	1.434
	Acid Sulphide (Cu, Ni)	0.062	3.4
Background	Paleozoic	0.084	
	Precambrian	0.080	

Poplar (leaves)	Gold (Non-Acid)	0.054	0.3
	Acid Sulphide (Cu, Pb, Zn, Ni)	(0.029 to 0.142)	(0.102 to 1.614)
	Silver (As) (Non-Acid)	0.073	0.075
Background	Paleozoic	0.089	
	Precambrian	0.073	
Tamarack (needles)	Gold (Non-Acid)	0.055	0.322
Basswood (leaves)	Gold (Non-Acid)	-0.025	-0.079
Aspen (leaves)	Gold (Non-Acid)	0.048	0.08
Background	Paleozoic	0.076	
Oak (leaves)	Smelting and Refining Residue (Co, Ag, As)	0.106	0.25
Fleabane (leaves, stems, flowers)	Smelting and Refining Residue (Co, Ag, As)	0.106	0.25
Background	Paleozoic	0.053	
Vetch (leaves, stems, flowers)			
Background	Paleozoic	0.062	
Maple (leaves)	Sulphide (Cu) (Non-Acid)	0.131	2.848
	Gold (Non-Acid)	0.087	0.719

	Refinery (As) Residue	0.131	0.31
Background	Paleozoic Precambrian	0.124 0.088	
Willow (leaves)	Gold (Non-Acid)	0.045	0.07
Background	Paleozoic	0.068	
Trefoil (leaves, stems, flowers)	Uranium (Acid)	(0.051 to 0.066)	(0.51 to 1.10)
	Silver (As) (Non-Acid)	(0.050 to 0.087)	(0.05 to 0.150)
	Gold (Non-Acid)	0.056	(0.3 to 5.3)
Background	Paleozoic	0.062	
Purple Clover (leaves, stems, flowers)	Gold (Non-Acid)	0.086	1
	Acid Sulphide (Cu, Ni)	0.055	
Background	Paleozoic	0.049	
Yellow Sweet Clover (leaves, stems, flowers)	Gold (Non-Acid)	0.040	2.000
	Acid Sulphide (Cu, Ni)	0.036	0.571
Background	Paleozoic	0.058	
Evergreen (needles)	Gold (Non-Acid)	0.033 (fir) 0.055 (pine)	0.06 5.5
Background	Paleozoic	0.058 (pine)	
Grasses (excluding roots)	Uranium (Acid)	0.065	0.8

	Gold (Non-Acid)	-0.045	-1.950
	Acid Sulphide (Cu, Ni, Pb, Zn)	0.072	1.372
	Refinery (As) Residue	0.116	0.28
Background	Paleozoic	0.059	

MOLYBDENUM

MOLYBDENUM LEVELS (ppm) in Vegetation

Vegetation Type	Tailings Type	Average concentration or (range)	Ratio Veg./Tailings
Cattail (leaves)	Gold (Non-Acid)	(0.30 to 20)	0.3
	Uranium (Non-Acid)	0.72	0.7
	Acid Sulphide (Cu, Ni, Pb, Zn)	0.3	0.08
	Sulphide (Cu) (Non-Acid)	15	6.8
	Silver (As) (Non-Acid)	76.3	55
Background	Paleozoic	1.5	
Horsetail (excluding roots)	Gold (Non-Acid)	(0.18 to 70)	-1.4
	Silver (As) (Non-Acid)	31.3	22.4
	Acid Sulphide (Cu, Pb, Zn, Pt)	0.14	0.05
	Uranium (Non-Acid)	1.05	1
	Sulphide (Cu) (Non-Acid)	15	6.8
Birch (leaves)	Gold (Non-Acid)	(0.19 to 81.3)	
	Uranium (Acid)	0.50	0.2
	(Non-Acid)	1.39	1.3
	Acid Sulphide (Cu, Ni)	0.28	0.3
Background	Paleozoic	0.85	
	Precambrian	0.08	

Poplar (leaves)	Gold (Non-Acid)	(0.18 to 84.8)	= 0.70
	Acid Sulphide (Cu, Ni, Pb, Zn)	(0.53 to 2.06)	0.2 to = 3.4
	Silver (As) (Non-Acid)	7.5	5.4
Background	Paleozoic Precambrian	0.20 0.08	
Tamarack (needles)	Gold (Non-Acid)	0.62	= 1.0
Basswood (leaves)	Gold (Non-Acid)	60.0	10.9
Aspen (leaves)	Gold (Non-Acid)	20.65	4.2
Background	Paleozoic	1.20	
Oak (leaves)	Smelting and Refining Residue (Co, Ag, As)	0.21	0.00
Mustard (leaves, stems, flowers)	Acid Sulphide (Cu, Ni)	0.67	0.6
Fleabane (leaves, stems, flowers)	Smelting and Refining Residue (Co, Ag, As)	1.44	0.00
Background	Paleozoic	0.55	
Vetch (leaves, stems, flowers)			
Background	Paleozoic	1.05	

Maple (leaves)	Sulphide (Cu) (Non-Acid)	10	4.5
	Gold (Non-Acid)	2.00	1.8
	Refinery (As) Residue	10	0.02
Background	Paleozoic Precambrian	1.4 0.14	
Willow (leaves)	Gold (Non-Acid)	24	= 8.4
Background	Paleozoic	0.22	
Trefoil (leaves, stems, flowers)	Uranium (Acid)	(0.23 to 15.0)	(= 0.02 to 5.6)
	Silver (As) (Non-Acid)	(46.9 to 68.8)	(33.5 to = 115)
	Gold (Non-Acid)	8.3	(1.5 to 94)
Background	Paleozoic	2.17	
Purple Clover (leaves, stems, flowers)	Gold (Non-Acid)	60	53
	Acid Sulphide (Cu, Ni)	1.06	
Background	Paleozoic	1.9	
Yellow Sweet Clover (leaves, stems, flowers)	Gold (Non-Acid)	28	13.3
	Acid Sulphide (Cu, Ni, Pb, Zn)	0.68	1.1
Background	Paleozoic	0.36	
Evergreen (needles)	Gold (Non-Acid)	0.20 (fir) 0.06 (pine)	= 0.01 = 0.1
Background	Paleozoic	1.4	

Grasses (excluding roots)	Uranium (Acid)	0.35	= 0.02
	Gold (Non-Acid)	(0.29 to 5.33)	= 0.8
	Acid Sulphide (Cu, Ni, Pb, Zn)	1.12	= 1.7
	Sulphide (Cu) (Non-Acid)	3.8	1.7
	Refinery (As) Residue	2.70	0.01
Background	Paleozoic	1.08	

NICKEL

NICKEL LEVELS (ppm) in Vegetation

Vegetation Type	Tailings Type	Average concentration or (range)	Ratio Veg./Tailings
Cattail (leaves)	Gold (Non-Acid)	6.5	= 0.16
	Uranium (Non-Acid)	(-3 to 5.71)	0.09 to -0.1
	(Acid)	-3	-1.5
	Acid Sulphide (Cu, Ni, Pb, Zn)	-2.7	0.02
	Sulphide (Cu) (Non-Acid)	3.57	= 0.36
	Silver (As) (Non-Acid)	(-3 to 5.36)	0.03 to -0.05
Background	Paleozoic	1.43	
Horsetail (excluding roots)	Gold (Non-Acid)	3.62	-0.20
	Silver (As) (Non-Acid)	8	0.04
	Acid Sulphide (Cu, Pb, Zn, Pt)	(1.43 to 113)	(0.02 to 0.03)
	Uranium (Non-Acid)	1.79	0.03
	Sulphide (Cu) (Non-Acid)	4.64	= 0.5
Background	Paleozoic	0.71	
Birch (leaves)	Gold (Non-Acid)	4.6	-0.2
	Uranium (Acid)	4.64	= 0.46
	(Non-Acid)	7.14	0.11
	Acid Sulphide (Cu, Ni)	30.35	0.01
Background	Paleozoic	0.71	
	Precambrian	2.86	

Poplar (leaves)	Gold (Non-Acid)	5.3	= 0.4
	Acid Sulphide (Cu, Ni, Zn, Pb)	(4.64 to 78.54)	0.05
	Silver (As) (Non-Acid)	3.21	0.02
	Uranium (Acid) (Non-Acid)	 -3 -3	 = 1.5 ? (-0.05 to -0.1)
Background	Paleozoic Precambrian	0.86 1.79	
Goldenrod (leaves, stems, flowers)	Gold (Non-Acid)	-3	-0.06
	Uranium (Non-Acid)	(-1 to 5)	(-0.00 to 0.3)
Tamarack (needles)	Gold (Non-Acid)	1.79	0.02
Basswood (leaves)	Gold (Non-Acid)	21.78	= 2.3
Aspen (leaves)	Gold (Non-Acid)	15.7	= 0.6
Background	Paleozoic	0.71	
Oak (leaves)	Smelting and Refining Residue (Co, Ag, As)	18.21	0.01
Mustard (leaves, stems, leaves)	Acid Sulphide (Cu, Ni)	7.85	0.00
Fleabane (leaves, stems, flowers)	Smelting and Refining Residue (Co, Ag, As)	34.63	0.02
Background	Paleozoic	0.71	

Vetch (leaves, stems, flowers)	Acid Sulphide (Cu)	-3	-0.1
Background	Paleozoic	0.71	
Maple (leaves)	Sulphide (Cu) (Non-Acid)	9.28	= 0.9
	Gold (Non-Acid)	2.50	0.05
	Refinery (As) Residue	9.28	0.01
Background	Paleozoic Precambrian	0.71 0.71	
Willow (leaves)	Gold (Non-Acid)	12.9	= 0.8
Background	Paleozoic	0.71	
Trefoil (leaves, stems, flowers)	Uranium (Acid)	(-3 to 5.00)	(-0.3 to = 0.5)
	Silver (As) (Non-Acid)	(12.4 to 19)	(0.00 to 0.3)
	Gold (Non-Acid)	6	= 0.4
Background	Paleozoic	3.93	
Purple Clover (leaves, stems, flowers)	Gold (Non-Acid)	6.5	= 0.7
	Acid Sulphide (Cu, Ni)	12.21	
Background	Paleozoic	0.71	
Yellow Sweet Clover (leaves, stems, flowers)	Gold (Non-Acid)	-3	-0.3
	Acid Sulphides (Cu, Ni, Pb, Zn)	(-3 to 20.7)	-0.2

	Uranium (Acid)	9	= 0.9
Background	Paleozoic	0.71	
Evergreen (needles)	Gold (Non-Acid)	-3 (spruce)	-0.1
		0.80 (fir)	0.03
		0.71 (pine)	= 0.07
	Uranium (Non-Acid)	-3 (Jack Pine)	-0.1
Background	Paleozoic	0.71 (pine)	
Grasses (excluding roots)	Uranium (Acid)	-2.0	-0.8
	(Non-Acid)	-3	-0.1 to -1.5
	Gold (Non-Acid)	-2.7	0.2
	Acid Sulphides (Cu, Ni, Pb, Zn)	(2.86 to 88)	0.4
	Sulphide (Cu) (Non-Acid)	2.86	= 0.3
	Refinery (As) Residue	(31.06 to 41)	(0.02 to 0.03)
Background	Paleozoic	0.71	

NITROGEN

NITROGEN LEVELS (ppm) in Vegetation

Vegetation Type	Tailings Type	Average concentration or (range)	Ratio Veg./Tailings
Cattail (leaves)	Gold (Non-Acid)	22,361	561
	Uranium (Non-Acid)	(6,810 to 20,000)	399 to 454
	Uranium (Acid)	27,000	386
	Sulphide (Acid)	22,793	383
	Sulphide (Non-Acid)	10,500	438
	Silver (with arsenic)	(20,500 to 22,780)	(488 to 1,627)
Background	Paleozoic	21,750	
Horsetail (whole plant excluding roots)	Gold (Non-Acid)	14,333	294
	Silver (with arsenic)	18,000	429
	Sulphide (Acid)	(11,730 to 16,500)	(280 to 348)
	Uranium (Non-Acid)	15,500	309
	Sulphide (Non-Acid)	15,500	646
Background	Paleozoic	24,000	
Birch (leaves)	Gold (Non-Acid)	20,214	295
	Uranium (Acid)	30,000	398
	Uranium (Non-Acid)	18,000	359

	Sulphide (Acid)	22,500	---
Background	Paleozoic Precambrian	24,000 23,000	
Poplar (leaves)	Gold (Non-Acid)	19,633	384
	Sulphide (Acid)	(22,800 to 28,500)	(410 to 601)
	Silver (with arsenic)	22,000	524
	Uranium (Acid)	16,760	559
	Uranium (Non-Acid)	(6,930 to 8,560)	(138 to 571)
Background	Paleozoic Precambrian	21,800 24,000	
Goldenrod (flowers, stems, leaves)	Gold (Non-Acid)	9,753	162
	Uranium (Non-Acid)	(4,860 to 9,200)	(184 to 194)
Tamarack (needles)	Gold (Non-Acid)	20,500	205
Basswood (leaves)	Gold (Non-Acid)	19,500	874
Aspen (leaves)	Gold (Non-Acid)	21,000	534
Background	Paleozoic	24,000	
Oak (leaves)	Refinery Residue (arsenic)	22,500	1,125
Mustard (leaves, stems, flowers)	Sulphide (Acid)	23,500	8,393

Fleabane (leaves, stems, flowers)	Refinery Residue (arsenic)	32,000	1,600
Background	Paleozoic	23,000	
Vetch (leaves, stems, flowers)	Sulphide (Acid)	27,270	413
Background	Paleozoic	36,500	
Maple (leaves)	Sulphide (Non-Acid)	23,000	958
	Gold (Non-Acid)	15,000	125
	Refinery Residue (arsenic)	23,000	1,150
Background	Paleozoic	14,500	
	Precambrian	18,500	
Willow (leaves)	Gold (Non-Acid)	15,167	526
Background	Paleozoic	27,500	
Trefoil (leaves, stems, flowers)	Uranium (Acid)	(15,400 to 32,000)	(332 to 800)
	Refinery Residue (arsenic)	(29,800 to 31,000)	(710 to 928)
	Gold (Non-Acid)	27,600	505
Background	Paleozoic	46,000	
Purple Clover (leaves, stems, flowers)	Gold (Non-Acid)	28,667	663
	Sulphide (Acid)	36,000	----
Background	Paleozoic	37,000	

Yellow Sweet Clover (leaves, stems, flowers)	Gold (Non-Acid)	15,780	809
	Sulphide (Acid)	23,950	867
	Uranium (Acid)	36,800	488
Background	Paleozoic	32,000	
Evergreen (needles)			
Spruce	Gold (Non-Acid)	5,360	153
Fir	Gold (Non-Acid)	14,500	967
Pine	Gold (Non-Acid)	1,500	23.4
Jack Pine	Uranium (Non-Acid)	14,380	959
Background (Pine)	Paleozoic	16,000	
Grasses	Uranium (Acid)	12,388	331
	Uranium (Non-Acid)	(3,770 to 4,850)	(194 to 251)
	Gold (Non-Acid)	8,940	295
	Sulphide (Acid)	22,273	505
	Sulphide (Non-Acid)	12,000	500
	Refinery Residue (arsenic)	(10,150 to 13,000)	(508 to 650)
Background	Paleozoic	24,200	

PHOSPHORUS

PHOSPHORUS LEVELS (ppm) in Vegetation

Vegetation Type	Tailings Type	Average concentration or (range)	Ratio Veg./Tailings
Cattail (leaves)	Gold (Non-Acid)	1,919	7.7
	Uranium (Non-Acid)	(550 to 1,500)	(1.6 to 2.1)
	Uranium (Acid)	3,200	28
	Sulphide (Acid)	2,028	9
	Sulphide (Non-Acid)	10,500	438
	Refinery Residue (arsenic)	(1,200 to 1,300)	2.5
Background	Paleozoic	1,900	
Horsetail (excluding roots)	Gold (Non-Acid)	1,213	2.6
	Refinery Residue (arsenic)	1,500	2.9
	Sulphide (Acid)	(800 to 1,300)	(3.6 to 3.9)
	Uranium (Non-Acid)	15,500	309
	Sulphide (Non-Acid)	1,100	4.8
Background	Paleozoic	2,600	
Birch (leaves)	Gold (Non-Acid)	1,643	1.2
	Uranium (Acid)	2,700	56
	Uranium (Non-Acid)	1,800	2

	Sulphide (Acid)	1,100	3.3
Background	Paleozoic Precambrian	2,900 1,800	
Poplar (leaves)	Gold (Non-Acid)	1,293	3.8
	Sulphide (Acid)	(2,100 to 2,300)	(3.2 to 7)
	Silver (Non-Acid)	1,200	2.3
	Uranium (Acid)	1,590	24
	Uranium (Non-Acid)	(1,120 to 1,690)	(1.2 to 6.4)
Background	Paleozoic Precambrian	1,600 1,800	
Goldenrod (stems, flowers, leaves)	Gold (Non-Acid)	1,747	2.4
	Uranium (Non-Acid)	(1,170 to 1,240)	(1.4 to 3.3)
Tamarack (needles)	Gold (Non-Acid)	1,200	1
Basswood (leaves)	Gold (Non-Acid)	1,600	1.1
Aspen (leaves)	Gold (Non-Acid)	1,200	1.4
Background	Paleozoic	2,300	
Oak (leaves)	Smelting and Refining Residue (Co, Ag, As)	2,100	1.9
Yellow Mustard (leaves, flowers, stems)	Sulphide (Acid) (Cu, Ni)	800	2.4

Fleabane (leaves, stems, flowers)	Smelting and Refining Residue (Co, Ag, As).	3,100	2.8
Background	Paleozoic	3,200	
Vetch (leaves, stems, flowers)	Sulphide (Acid) (Cu)	2,610	3.3
Background	Paleozoic	2,500	
Maple (leaves)	Sulphide (Non-Acid) (Cu)	1,500	6.6
	Gold (Non-Acid)	1,000	0.8
	Refinery Residue (high arsenic)	1,500	1.4
Background	Paleozoic	1,200	
	Precambrain	1,400	
Willow (leaves)	Gold (Non-Acid)	833	1.2
Background	Paleozoic	2,100	
Trefoil (leaves, stems, flowers)	Uranium (Acid)	(1,450 to 2,300)	(12.8 to 35)
	Silver (arsenic-bearing)	(1,850 to 2,700)	(3.5 to 4.8)
	Gold (Non-Acid)	1,370	3.1
Background	Paleozoic	3,900	
Purple Clover (leaves, stems, flowers)	Gold (Non-Acid)	1,600	5.7
	Sulphide (Acid) (Cu, Ni)	2,800	
Background	Paleozoic	2,700	

Yellow Sweet Clover (leaves, stems, flowers)	Gold (Non-Acid)	2,250	14
	Sulphides (Acid)	2,593	9.5
	Uranium (Acid)	4,220	88
Background	Paleozoic	3,700	
Evergreen (needles)			
Fir (needles)	Gold (Non-Acid)	700	7
Spruce (needles)	Gold (Non-Acid)	640	9.3
Pine (needles)	Gold (Non-Acid)	900	1.9
Jack Pine (needles)	Uranium (Non-Acid)	1,040	3.9
Pine (needles)	Background (Paleozoic)	1,500	
Grasses (excluding roots)	Uranium (Acid)	1,784	12
	Uranium (Non-Acid)	(320 to 600)	(1.2 to 1.7)
	Gold (Non-Acid)	923	1.9
	Sulphide (Acid) (Cu, Ni, Pb, Zn)	2,093	3.9
	Sulphide (Non-Acid) (Cu)	800	3.5
	Refinery Residue (high arsenic)	(1,095 to 1,900)	(1.1 to 1.7)
Background	Paleozoic	2,400	

POTASSIUM

POTASSIUM LEVELS (ppm) in Vegetation

Vegetation Type	Tailings Type	Average concentration or (range)	Ratio Veg./Tailings
Cattail (leaves)	Gold (Non-Acid)	19,200	1.7
	Uranium (Non-Acid)	(8,600 to 22,000)	0.5 to 1.2
	Uranium (Acid)	35,800	3.1
	Sulphide (Acid) (Cu, Ni, Pb, Zn)	22,575	2.1
	Sulphide (Non-Acid) (Cu)	17,200	1.1
	Silver (with arsenic)	(20,000 to 22,600)	(1.9 to 3.6)
Background	Paleozoic	17,100	
Horsetail (excluding roots)	Gold (Non-Acid)	16,433	1.1
	Silver (with arsenic)	28,733	2.7
	Sulphides (Acid) (Cu, Ni, Pb, Zn, Pt)	(16,900 to 22,200)	1.3
	Uranium (Non-Acid)	27,400	1.5
	Sulphide(Cu) (Non-Acid)	13,900	0.9
Background	Paleozoic	27,900	
Birch (leaves)	Gold (Non-Acid)	8,143	1.1
	Uranium (Acid)	16,100	0.6
	Uranium (Non-Acid)	13,300	0.8

	Sulphide (Acid) (Cu, Ni)	9,100	1.9
Background	Paleozoic	8,100	
	Precambrian	15,500	
Poplar (leaves)	Gold (Non-Acid)	11,200	0.8
	Sulphide (Acid) (Cu, Pb, Zn, Ni)	(21,100 to 27,300)	(1.3 to 2.9)
	Silver (with arsenic)	12,600	1.2
	Uranium (Acid)	13,500	2.1
	Uranium (Non-Acid)	(5,800 to 6,000)	0.3
Background	Paleozoic	6,900	
	Precambrian	7,100	
Goldenrod (leaves, stems, flowers)	Gold (Non-Acid)	16,568	0.5
	Uranium (Non-Acid)	(14,100 to 16,500)	0.8
Tamarack (needles)	Gold (Non-Acid)	9,300	1.1
Basswood (leaves)	Gold (Non-Acid)	13,500	0.3
Aspen (leaves)	Gold (Non-Acid)	16,750	0.5
Background	Paleozoic	9,000	
Oak (leaves)	Smelting and Refining Residue (Co, Ag, As)	7,100	23.7

Yellow Mustard (leaves, stems, flowers)	Sulphide (Acid) (Cu, Ni)	14,700	3.1
Fleabane (leaves, stems, flowers)	Smelting and Refining Residue (Co, Ag, As)	27,000	90
Background	Paleozoic	25,600	
Vetch (leaves, stems, flowers)	Sulphide (Acid) (Cu)	15,200	51
Background	Paleozoic	21,700	
Maple (leaves)	Sulphide (Non-Acid) (Cu)	18,800	1.2
	Gold (Non-Acid)	12,300	0.5
	Refinery Residue (high arsenic)	18,800	63
Background	Paleozoic	4,400	
	Precambrian	9,100	
Willow (leaves)	Gold (Non-Acid)	10,067	0.5
Background	Paleozoic	9,600	
Trefoil (leaves, stems, flowers)	Uranium (Acid)	(10,300 to 25,100)	(0.4 to 3.7)
	Silver (with arsenic)	(21,000 to 30,100)	(2 to 5.1)
	Gold (Non-Acid)	15,940	1.3
Background	Paleozoic	41,700	

Purple Clover (leaves, stems, flowers)	Gold (Non-Acid)	22,700	variable
	Sulphide (Acid) (Cu, Ni)	22,400	
Background	Paleozoic	21,700	
Yellow Sweet Clover (leaves, stems, flowers)	Gold (Non-Acid)	14,300	1.3
	Sulphide (Acid)	13,200	variable
	Uranium (Acid)	19,100	0.7
Background	Paleozoic	15,200	
Evergreen (needles)			
Fir (needles)	Gold (Non-Acid)	3,700	6.2
Spruce (needles)	Gold (Non-Acid)	6,800	1.3
Pine (needles)	Gold (Non-Acid)	3,300	0.2
Jack Pine (needles)	Uranium (Non-Acid)	6,300	0.4
Pine (needles) Background	Paleozoic	4,800	
Grasses (excluding roots)	Uranium (Acid)	12,100	1.5
	Uranium (Non-Acid)	(5,400 to 7,800)	(0.3 to 0.4)
	Gold (Non-Acid)	5,788	0.4
	Sulphide (Acid)	20,431	1.7
	Sulphide (Non-Acid)	12,700	0.8

	Refinery Residue (high arsenic)	(4,300 to 12,300)	(14.3 to 41)
Background	Paleozoic	25,600	

SELENIUM

SELENIUM LEVELS (ppm) in Vegetation

Vegetation Type	Tailings Type	Average concentration or (range)	Ratio Veg./Tailings
Cattail (leaves)	Gold (Non-Acid)	0.08	= 0.03
	Uranium (Non-Acid)	(0.13 to -1)	(= 0.13 to -2.0)
	(Acid)	-1	-2.0
	Acid Sulphide (Cu, Ni, Pb, Zn)	-0.6	0.2
	Sulphide (Cu) (Non-Acid)	0.12	0.02
	Silver (As)	(0.05 to -1)	(0.03 to -1)
Background	Paleozoic	0.07	
Horsetail (excluding roots)	Gold (Non-Acid)	-0.06	-0.02
	Silver (As) (Non-Acid)	-0.04	-0.02
	Acid Sulphide (Cu, Pb, Zn, Pt)	(-1 to 16)	(0.2 to -0.3)
	Uranium (Non-Acid)	0.02	= 0.02
	Sulphide (Cu) (Non-Acid)	0.06	0.01
Background	Paleozoic	0.03	
Birch (leaves)	Gold (Non-Acid)	0.05	-0.01
	Uranium (Acid)	0.03	= 0.03
	(Non-Acid)	0.05	= 0.05
	Acid Sulphide (Cu, Ni)	0.13	0.01
Background	Paleozoic	0.09	
	Precambrian	0.03	

Poplar (leaves)	Gold (Non-Acid)	0.09	= 0.03
	Acid Sulphide (Cu, Pb, Zn, Ni)	(0.55 to 22)	(0.04 to 0.3)
	Silver (As) (Non-Acid)	0.02	0.01
	Uranium (Acid)	-1	= 2 ?
	(Non-Acid)	-1	(= 1 ? to = 2 ?)
Background	Paleozoic	0.07	
	Precambrian	0.02	
Goldenrod (leaves, stems, flowers)	Gold (Non-Acid)	-1	-0.5
	Uranium (Non-Acid)	-1	-1 to -2
Tamarack (needles)	Gold (Non-Acid)	0.28	0.09
Basswood (leaves)	Gold (Non-Acid)	0.12	0.06
Aspen (leaves)	Gold (Non-Acid)	0.08	= 0.06
Background	Paleozoic	0.08	
Oak (leaves)	Smelting and Refining Residue (Co, Ag, As)	0.05	= 0.1
Mustard (leaves, stems, flowers)	Acid Sulphide (Cu, Ni)	0.16	0.02
Fleabane (leaves, stems, flowers)	Smelting and Refining Residue (Co, Ag, As)	0.02	= 0.04
Background	Paleozoic	0.05	

Vetch (leaves, stems, flowers)	Acid Sulphide (Cu)	-1	-2
Background	Paleozoic	0.05	
Maple (leaves)	Sulphide (Cu) (Non-Acid)	0.04	0.01
	Gold (Non-Acid)	0.17	= 0.17
	Refinery (As) Residue	0.04	= 0.08
Background	Paleozoic Precambrian	0.06 -0.02	
Willow (leaves)	Gold (Non-Acid)	0.06	= 0.03
Background	Paleozoic	0.09	
Trefoil (leaves, stems, flowers)	Uranium (Acid)	(0.02 to 0.05)	(0.02 to = 0.05)
	Silver (As) (Non-Acid)	(-0.06 to 0.07)	(-0.03 to = 0.07)
	Gold (Non-Acid)	-0.04	0.02
Background	Paleozoic	0.03	
Purple Clover (leaves, stems, flowers)	Gold (Non-Acid)	0.07	= 0.03
	Acid Sulphide (Cu, Ni)	0.03	
Background	Paleozoic	0.03	
Yellow Sweet Clover (leaves, flowers, stems)	Gold (Non-Acid)	-1	-1
	Acid Sulphide (Cu, Ni, Pb, Zn)	-0.7	-0.1

	Uranium (Acid)	-1	-1
Background	Paleozoic	0.05	
Evergreen (needles)	Gold (Non-Acid)	-1 (spruce) 0.01 (fir) 0.11 (pine)	-2 0.02 = 0.1
	Uranium (Non-Acid)	-1 (Jack pine)	-2
Background	Paleozoic	0.06 (pine)	
Grasses (excluding roots)	Uranium (Acid)	0.06	= 0.09
	(Non-Acid)	-1	-2
	Gold (Non-Acid)	-0.5	0.3
	Acid Sulphide (Cu, Ni, Pb, Zn)	0.29	0.02
	Sulphide (Cu) (Non-Acid)	0.04	0.01
	Refinery (As) Residue	(0.05 to -1)	= 0.1 to -2
Background	Paleozoic	0.06	

SODIUM

SODIUM LEVELS (ppm) in Vegetation

Vegetation Type	Tailings Type	Average concentration or (range)	Ratio Veg./Tailings
Cattail (leaves)	Gold (Non-Acid)	400	0.2
	Uranium (Non-Acid)	(800 to 1,035)	(0.03 to 0.05)
	Uranium (Acid)	327	1.1
	Acid Sulphide (Cu, Ni, Pb, Zn)	700	-0.1
	Sulphide (Cu) (Non-Acid)	500	0.05
	Silver (As)	(95 to 200)	0.00 to 0.02
Background	Paleozoic	1,100	
Horsetail (excluding roots)	Gold (Non-Acid)	600	0.14
	Silver (As) (Non-Acid)	433	0.05
	Acid Sulphide (Cu, Pb, Zn, Pt)	(32 to 600)	0.2
	Uranium (Non-Acid)	500	0.02
	Sulphide (Cu) (Non-Acid)	400	0.04
Background	Paleozoic	400	
Birch (leaves)	Gold (Non-Acid)	257	0.1
	Uranium (Acid)	300	0.3
	(Non-Acid)	200	0.01
	Sulphide (Acid) (Cu, Ni)	200	0.02
Background	Paleozoic	400	
	Precambrian	300	

Poplar (leaves)	Gold (Non-Acid)	340	0.04
	Acid Sulphide (Cu, Ni, Pb, Zn)	(500 to 600)	(0.03 to 0.08)
	Silver (Non-Acid)	200	0.02
	Uranium (Acid)	-4	0.00
	(Non-Acid)	(-4 to 11)	(-0.00 to 0.00)
Background	Paleozoic	400	
	Precambrian	1,500	
Goldenrod (leaves, stems, flowers)	Gold (Non-Acid)	(-4 to 78)	-0.00
	Uranium (non-Acid)	(-4 to 76)	(-0.00 to 0.00)
Tamarack (needles)	Gold (Non-Acid)	200	0.01
Basswood (leaves)	Gold (Non-Acid)	300	0.02
Aspen (leaves)	Gold (Non-Acid)	350	0.03
Background	Paleozoic	200	
Oak (leaves)	Smelting and Refining Residue (Co, Ag, As)	100	0.4
Mustard (leaves, flowers, stems)	Acid Sulphide (Cu, Ni)	300	0.03
Fleabane (leaves, flowers, stems)	Smelting and Refining Residue (Co, Ag, As)	400	1.5
Background	Paleozoic	300	

Vetch (leaves, stems, flowers)	Acid Sulphide (Cu)	98	0.2
Background	Paleozoic	300	
Maple (leaves)	Sulphide (Cu) (Non-Acid)	1,100	0.1
	Gold (Non-Acid)	200	0.01
	Refinery (As) Residue	1,100	4.2
Background	Paleozoic Precambrian	300 400	
Willow (leaves)	Gold (Non-Acid)	267	0.04
Background	Paleozoic	400	
Trefoil (leaves, flowers, stems)	Uranium (Acid)	(7 to 400)	(0.02 to 1.4)
	Silver (As)	300	(0.00 to 0.04)
	Gold (Non-Acid)	260	0.04
Background	Paleozoic	200	
Purple Clover (leaves, stems, flowers)	Gold (Non-Acid)	300	0.1
	Acid Sulphide (Cu, Ni)	300	
Background	Paleozoic	300	
Yellow Sweet Clover (leaves, stems, flowers)	Gold (Non-Acid)	-4	-0.00
	Acid Sulphide (Cu, Ni, Pb, Zn)	158	0.01

	Uranium (Acid)	98	0.08
Background (white sweet clover)	Paleozoic	600	
Evergreen (needles)	Gold (Non-Acid)	-4 (spruce) 200 (fir) 300 (pine)	-0.00 0.6 0.06
	Uranium (Non-Acid)	-4 (Jack Pine)	-0.00
Background	Paleozoic	400	
Grasses (excluding roots)	Uranium (Acid)	400	0.8
	Uranium (Non-Acid)	(-4 to 176)	-0.00 to 0.01
	Gold (Non-Acid)	low 12.5;high 320	low 0.00;high 0.09
	Acid Sulphide (Cu, Ni, Pb, Zn)	458	0.04
	Sulphide (Cu) (Non-Acid)	400	0.04
	Refinery (As) Residue	(90 to 500)	(0.3 to 1.9)
Background	Paleozoic	500	

SULPHUR

SULPHUR LEVELS (ppm) in Vegetation

Vegetation Type	Tailings Type	Average concentration or (range)	Ratio Veg./Tailings
Cattail (leaves)	Gold (Non-Acid)	3,513	0.4
	Uranium (Non-Acid)	(1,600 to 1,900)	(0.09 to 0.2)
	Uranium (Acid)	3,700	0.2
	Acid Sulphide (Cu, Ni, Pb, Zn)	4,850	0.4
	Sulphide (Cu) (Non-Acid)	3,900	0.3
	Silver (As)	(3,100 to 6,400)	(0.6 to 3.2)
Background	Paleozoic	1,300	
Horsetail (excluding roots)	Gold (Non-Acid)	-8,193	-0.9
	Silver (As) (Non-Acid)	5,866	1.1
	Acid Sulphide (Cu, Pb, Zn, Pt)	(3,000 to 13,600)	(0.2 to 1.1)
	Uranium (Non-Acid)	12,000	0.94
	Sulphide (Cu) (Non-Acid)	13,000	0.9
Background	Paleozoic	-13,000	
Birch (leaves)	Gold (Non-Acid)	1,400	0.2
	Uranium (Acid)	6,200	1.3
	(Non-Acid)	1,100	0.09
	Sulphide (Acid) (Cu, Ni)	3,300	0.06
Background	Paleozoic	1,300	
	Precambrian	800	

Poplar (leaves)	Gold (Non-Acid)	3,453	0.3
	Acid Sulphide (Cu, Zn, Pb, Ni)	5,600	0.3
	Silver (As) (Non-Acid)	900	0.2
	Uranium (Acid)	4,400	0.6
	(Non-Acid)	(1,900 to 6,700)	(0.1 to 0.4)
Background	Paleozoic	2,300	
	Precambrian	1,600	
Goldenrod (leaves, stems flowers)	Gold (Non-Acid)	(-100 to 4,100)	-0.2
	Uranium (Non-Acid)	(3,200 to 4,600)	(0.3 to 0.8)
Tamarack (needles)	Gold (Non-Acid)	4,700	0.2
Basswood (leaves)	Gold (Non-Acid)	6,800	1.5
Aspen (leaves)	Gold (Non-Acid)	5,300	1.0
Background	Paleozoic	2,400	
Oak (leaves)	Smelting and Refining Residue (Co, Ag, As)	1,500	0.01
Mustard (leaves, flowers, stems)	Acid Sulphide (Cu, Ni)	700	0.01

Fleabane (leaves, stems, flowers)	Smelting and Refining Residue (Co, Ag, As)	4,500	0.04
Background	Paleozoic	1,600	
Vetch (leaves, stems, flowers)	Acid Sulphide (Cu)	3,800	0.6
Background	Paleozoic	1,800	
Maple (leaves)	Sulphide (Cu) (Non-Acid)	4,000	0.3
	Gold (Non-Acid)	4,500	0.7
	Refinery (As) Residue	4,000	0.04
Background	Paleozoic Precambrian	1,700 2,500	
Willow (leaves)	Gold (Non-Acid)	3,900	0.7
Background	Paleozoic	5,600	
Trefoil (leaves, stems, flowers)	Uranium (Acid)	(1,400 to 2,000)	(0.03 to 0.3)
	Silver (As)	(2,350 to 3,800)	(0.4 to 1.5)
	Gold (Non-Acid)	1,117	0.1
Background	Paleozoic	3,900	
Purple Clover (leaves, stems, flowers)	Gold (Non-Acid)	250	0.03
	Acid Sulphide (Cu, Ni)	1,800	
Background	Paleozoic	1,600	

Yellow Sweet Clover (leaves, stems, flowers)	Gold (Non-Acid)	4,900	1.1
	Acid Sulphides (Cu, Ni, Pb, Zn)	2,100	0.3
	Uranium (Acid)	6,200	1.3
Background	Paleozoic	1,500	
Evergreen (needles)	Gold (Non-Acid)	4,500 (spruce)	1.6
		500 (fir)	0.03
		100 (pine)	0.00
	Uranium (Non-Acid)	4,500 (Jack Pine)	0.2
Background	Paleozoic	800 (pine)	
Grasses (excluding roots)	Uranium (Acid)	2,060	0.5
	(Non-Acid)	(3,300 to 6,800)	0.4 to 0.6
	Gold (Non-Acid)	2,267	0.1
	Acid Sulphide (Cu, Ni, Pb, Zn)	2,881	0.3
	Sulphide (Cu) (Non-Acid)	1,300	0.09
	Refinery (As) Residue	(4,100 to 1,700)	0.01 to 0.04
Background	Paleozoic	3,300	

VANADIUM

VANADIUM LEVELS (ppm) in Vegetation

Vegetation Type	Tailings Type	Average concentration or (range)	Ratio Veg./Tailings
Cattail (leaves)	Gold (Non-Acid)	-6	-0.08
	Uranium (Non-Acid)	-6	-0.2
	(Acid)	-6	-0.2
	Acid Sulphide (Cu, Ni, Zn, Pb)	-6	-0.04
	Silver (As) (Non-Acid)	-6	-0.04
Horsetail (excluding roots)	Gold (Non-Acid)	-6	-0.05
	Acid Sulphide (Cu, Pb, Zn, Pt)	-6	-0.04
Poplar (leaves)	Uranium (Acid)	-6	= 0.6 ?
	(Non-Acid)	-6	(-0.04 to -0.2)
Goldenrod (leaves, stems, flowers)	Gold (Non-Acid)	-6	-0.04
	Uranium (Non-Acid)	-6	-0.04 to -0.2
Vetch (leaves, flowers, stems)	Acid Sulphide (Cu)	-6	-0.2
Trefoil (leaves, stems, flowers)	Uranium (Acid)	-6	-0.6
Yellow Sweet Clover (leaves, flowers, stems)	Gold (Non-Acid)	-6	-0.1
	Acid Sulphide (Cu, Pb, Zn)	-6	-0.2
	Uranium (Acid)	-6	-0.2

Evergreen (needles)	Gold (Non-Acid)	-6 (spruce)	-0.2
	Uranium (Non-Acid)	-6	-0.2
Grasses (excluding roots)	Uranium (Acid)	-6	-0.5
	(Non-Acid)	-6	-0.2
	Gold (Non-Acid)	-6	-0.05
	Acid Sulphide (Cu,Ni, Pb, Zn)	-6	-0.2
	Refinery (As) Residue	-6	-0.8

ZINC

ZINC LEVELS (ppm) in Vegetation

Vegetation Type	Tailings Type	Average concentration or (range)	Ratio Veg./Tailings
Cattail (leaves)	Gold (Non-Acid)	17.9	0.21
	Uranium (Non-Acid)	(16 to 23)	(0.07 to 0.2)
	(Acid)	24	0.6
	Acid Sulphide (Cu, Ni, Pb, Zn)	43.3	0.3
	Sulphide (Cu) (Non-Acid)	19	0.1
	Silver (As) (Non-Acid)	(13 to 75)	(0.1 to 0.3)
Background	Paleozoic	24	
Horsetail (excluding roots)	Gold (Non-Acid)	60	0.5
	Silver (As) (Non-Acid)	25	0.23
	Acid Sulphide (Cu, Pb, Zn, Pt)	(22 to 274)	(0.2 to 0.3)
	Uranium (Non-Acid)	32	0.22
	Sulphide (Cu) (Non-Acid)	42	0.3
Birch (leaves)	Gold (Non-Acid)	329	3.4
	Uranium (Acid)	125	12.8
	(Non-Acid)	306	2.1
	Acid Sulphide (Cu, Ni)	83	0.6
Background	Paleozoic	62	
	Precambrian	403	

Poplar (leaves)	Gold (Non-Acid)	574	5.4
	Acid Sulphide (Cu, Ni, Zn, Ni)	(104 to 1,417)	0.9
	Silver (As) (Non-Acid)	143	1.3
	Uranium (Acid)	189	31.5
	(Non-Acid)	(192 to 274)	(0.9 to 1.9)
Background	Paleozoic	153	
	Precambrian	612	
Goldenrod (leaves, stems, flowers)	Gold (Non-Acid)	47.3	0.5
	Uranium (Non-Acid)	(115 to 120)	(0.8 to 2.3)
Tamarack (needles)	Gold (Non-Acid)	32	0.5
Basswood (leaves)	Gold (Non-Acid)	765	7.1
Aspen (leaves)	Gold (Non-Acid)	966	9.1
Background	Paleozoic	97	
Oak (leaves)	Smelting and Refining Residue (Co, Ag, As)	19	0.08
Mustard (leaves, stems, flowers)	Acid Sulphide (Cu, Ni)	24	0.2
Fleabane (leaves, stems, flowers)	Smelting and Refining Residue (Co, Ag, As)	72	0.3
Background	Paleozoic	87	

Vetch (leaves, stems, flowers)	Acid Sulphide (Cu)	17	0.1
Background	Paleozoic	48	
Maple (leaves)	Sulphide (Cu) (Non-Acid)	13	0.09
	Gold (Non-Acid)	35	0.3
	Refinery (As) Residue	13	0.05
Background	Paleozoic Precambrian	24 37	
Willow (leaves)	Gold (Non-Acid)	548	3.8
Background	Paleozoic	379	
Trefoil (leaves, stems, flowers)	Uranium (Acid)	(6.0 to 56)	(0.6 to 8.3)
	Silver (As) (Non-Acid)	(25 to 54)	(0.2 to 0.5)
	Gold (Non-Acid)	57	0.2
Background	Paleozoic	56	
Purple Clover (leaves, stems, flowers)	Gold (Non-Acid)	46	0.1
	Acid Sulphide (Cu, Ni)	26	
Background	Paleozoic	39	
Yellow Sweet Clover (leaves, stems, flowers)	Gold (Non-Acid)	35	0.7
	Acid Sulphide (Cu, Ni, Pb, Zn)	(16 to 670)	0.3

	Uranium (Acid)	22	2.2
Background	Paleozoic	31	
Evergreen (needles)	Gold (Non-Acid)	132 (spruce)	2.6
		119 (fir)	0.9
		51 (pine)	0.1
	Uranium (Non-Acid)	108 (Jack Pine)	0.5
Background	Paleozoic	32 (pine)	
Grasses (excluding roots)	Uranium (Acid)	22.4	2.1
	(Non-Acid)	(83 to 160)	0.7 to 1.7
	Gold (Non-Acid)	32.3	0.3
	Acid Sulphide (Cu, Ni, Pb, Zn)	(23 to 966)	0.3
	Sulphide (Cu) (Non-Acid)	40	0.3
	Refinery (As) Residue	26	0.1
Background	Paleozoic	42	

APPENDIX A

SAMPLING AND ANALYSIS

SAMPLING AND ANALYSIS

In the summer and fall of 1977, 177 composite samples of vegetation growing on 35 Ontario tailings areas were collected and analyzed for the following 23 parameters.

nitrogen
phosphorus
potassium
calcium
magnesium
sodium
sulphur
selenium
boron
arsenic
nickel
vanadium
lead
cadmium
chromium
iron
manganese
copper
zinc
aluminum
molybdenum
cobalt
mercury

During the 1980 field season, a further 55 composite samples were collected from an additional 27 mining properties and analysed for similar parameters.

Analysis of plant material collected was carried out by:

a) Plant Analysis Laboratory
University of Guelph
Guelph, Ontario

b) Enviroclean Laboratory
Division of MacLaren Engineers, Planners and Scientists Inc.
London, Ontario

In all cases, clean but unwashed vegetation samples were placed in protective ventilated containers and allowed to air-dry for several weeks.

Analytical methodology involved drying the samples to a constant weight at 110°C and then grinding them to pass a 0.5 mm. mesh sieve. The samples were normally stored in closed bottles in a dessicator until analysis was complete.

Total nitrogen and total phosphorus determinations involved digesting the samples with concentrated sulphuric acid and mercuric oxide in a block digester. After cooling, both parameters were determined by Auto Analyser.

Total arsenic and total selenium values were obtained by digesting the samples with nitric acid and perchloric acid in a block digester. After cooling and reduction with potassium iodide, the parameters were determined by hydride formation and non-flame atomic absorption spectrometry.

Total sulphur was determined using a Leco furnace.

The determination of most other parameters including potassium, calcium, magnesium, sodium, copper, nickel, zinc, cadmium, cobalt, iron, manganese, chromium and vanadium was achieved by digesting the samples in nitric and perchloric acids in a block digester. After cooling and making to volume, the metals were determined by flame atomic absorption.

Routine quality assurance procedures included:

(i) analysis of blank solutions to establish background levels of contamination

(ii) spiking of samples to determine recovery

(iii) duplicate analyses to determine reproducibility

(iv) check of standards to determine uniform instrument response

It should be noted that NONE OF THE SAMPLES SUBMITTED FOR ANALYSIS INCLUDED THE ROOTS OF THE PLANTS.

Unless otherwise indicated, all analytical results in this report refer to the dry weight of the plant tissues being tested and are expressed as "parts per million".

In general, the vegetation sampled for this report was growing in areas remote from the influence of smelters, refineries and similar sources of airborne contaminants.

The vegetation species sampled were selected on the basis of their common occurrence in and around Ontario tailings areas. Only specimens of roughly the same age, maturity of foliage, and coming from similar positions on the plants were collected. Relevant background (vegetation) samples were taken in carefully chosen locations.

The vegetation samples collected were visually clean and were not washed prior to analysis. There were several reasons for this:

(a) there appears to be a minor but continuing dispute among scientists as to the practical significance of analytical results based on washed versus unwashed vegetation samples,

(b) animals (domestic or wild) grazing on vegetation growing on mineral tailings areas (or any other type of industrial solid waste) will consume the plant (usually excluding the root) in its unwashed condition,

(c) straw, hay or any other related agricultural product harvested from a mineral waste area will consist of the vegetation in its unwashed condition.

THIS REPORT CONCERNS ITSELF WITH THE PRACTICAL ENVIRONMENTAL IMPLICATIONS OF METAL ETC. LEVELS IN (AND ON) VEGETATION GROWING ON INDUSTRIAL SOLID WASTE DISPOSAL SITES IN ONTARIO.

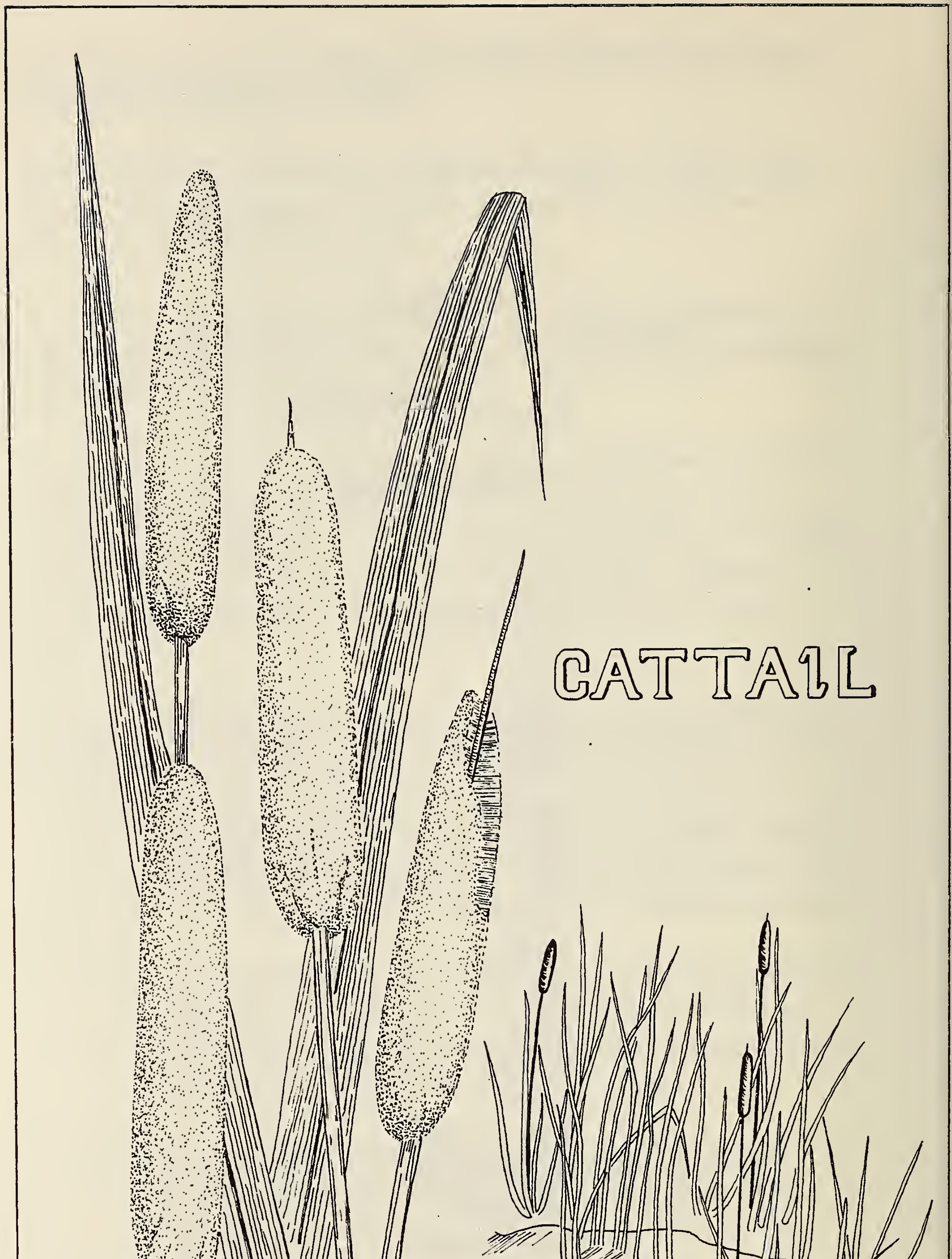
APPENDIX B

M.O.E. ANALYTICAL DATA

VEGETATION SAMPLES

CATTAIL
FIELD HORSETAIL
BIRCH
POPLAR
GOLDENROD
TAMARACK
BASSWOOD
ASPEN
OAK
MUSTARD
FLEABANE
VETCH
MAPLE
WILLOW
TREFOIL
PURPLE CLOVER
YELLOW CLOVER
EVERGREENS
MISC. GRASSES

NOTE: All results are expressed as "parts per million" and are based on dry vegetation samples. See Appendix A for further explanations.



CATTAIL

VEGETATION: Cattail Leaves (a)
TAILINGS TYPE: Gold, (Non-Acid)

Parameter	Veg. Sample 53	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 58	Conc. in Tailings	Ratio Veg./Tail.
N ppm	24,000			31,500	313	101
P ppm	1,300			2,600	238	11
K ppm	14,300	N/A		21,600	9,210	2.3
Ca ppm	7,200			7,000	99	71
Mg ppm	4,000			2,500	1,190	2.1
Na ppm	300			300	1,490	0.2
S ppm	1,000			5,500	33,966	0.2
Se ppm	0.1			0.09	12	0.01
B ppm	17			36	77	0.5
As ppm	0.16			0.1	386	0.00
Ni ppm	4.28			11.06	386	0.03
Pb ppm	2.19			4.06	646	0.01
Cd ppm	-0.08			-0.08	51	-0.00
Cr ppm	1.03			0.74	109	0.01
Fe ppm	40			190	370,000	0.00
Mn ppm	915			795	-10	=80
Cu ppm	5.4			7.6	1,820	0.00
Zn ppm	16			21	99	0.21
Al ppm	31			44	11,000	0.00
Mo ppm	0.44			0.84	55	0.02
Co ppm	0.5			1.33	463	0.00
Hg ppm	0.069			0.073	9.46	0.008
V ppm	-			-	119	-

VEGETATION: Cattail Leaves (b)
TAILINGS TYPE: Gold, (Non-Acid)

Parameter	Veg. Sample 67	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 94	Conc. in Tailings	Ratio Veg./Tail.
N ppm	25,000	83.4	300	15,000	14	1071
P ppm	1,500	514	2.9	1,000	1,560	0.6
K ppm	15,600	5,950	2.6	15,200	38,100	0.4
Ca ppm	9,500	4,890	1.9	13,400	3,430	3.9
Mg ppm	3,500	11,100	0.3	1,600	8,770	0.2
Na ppm	300	16,300	0.0	800	17,600	0.05
S ppm	4,200	18,248	0.2	1,300	6,960	0.2
Se ppm	0.15	4	0.04	0.08	4	0.02
B ppm	28	92	0.30	37	101	0.37
As ppm	1.6	825	0.0	0.13	562	0.00
Ni ppm	15.35	399	0.04	3.93	-10	=0.40
Pb ppm	1.56	14	0.11	0.8	9	0.09
Cd ppm	-0.08	0.9	-0.09	-0.08	0.6	-0.13
Cr ppm	0.59	566	0.00	0.88	124	0.01
Fe ppm	40	66,500	0.00	60	47,000	0.00
Mn ppm	726	1,300	0.53	774	648	1.19
Cu ppm	5.4	173	0.03	3.8	76	0.05
Zn ppm	18	355	0.05	15	200	0.08
Al ppm	31	9,310	0.00	17	33,800	0.00
Mo ppm	0.53	3,416	0.00	20	1.6	12.5
Co ppm	0.67	37	0.02	0.75	13	0.06
Hg ppm	0.042	0.198	0.212	-0.025	3.76	-0.007
V ppm	-	269	-		114	-

VEGETATION: Cattail Leaves (c)
TAILINGS TYPE: Gold, (Non-Acid)

Parameter	Veg. Sample 97	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 121	Conc. in Tailings	Ratio Veg./Tail.
N ppm	24,000	313	76.7	20,000	19.5	1,026
P ppm	2,100	238	8.8	2,100	157	13.4
K ppm	18,400	9,210	2	22,400	10,600	2.1
Ca ppm	7,700	99	77.8	12,100	2,440	5
Mg ppm	4,800	1,190	4	600	5,270	0.1
Na ppm	1,000	1,490	0.7	1,500	13,800	0.1
S ppm	4,800	33,966	0.14	2,100	4,496	0.5
Se ppm	0.05	12	0.00	0.02	-1	=0.02
B ppm	24	77	0.31	27	100	0.27
As ppm	0.1	386	0.00	0.8	59	0.01
Ni ppm	4.28	386	0.01	4.64	-10	=0.46
Pb ppm	4.06	646	0.01	1.25	17	0.07
Cd ppm	0.16	51	0.00	-0.08	0.3	-0.27
Cr ppm	0.88	109	0.01	2.06	68	0.03
Fe ppm	250	370,000	0.00	60	15,500	0.00
Mn ppm	113	-10	=11.3	624	107	5.8
Cu ppm	6.3	1,820	0.00	4.1	39	0.11
Zn ppm	18	99	0.18	21	48.8	0.4
Al ppm	20	11,100	0.00	33	28;600	0.00
Mo ppm	15	55	0.27	2	2.1	1
Co ppm	0.5	463	0.00	0.49	20	0.02
Hg ppm	0.044	9.46	0.005	0.036	0.020	1.800
V ppm	-	119	-	-	78	-

VEGETATION: Cattail Leaves (d)
TAILINGS TYPE: Gold, (Non-Acid)

Parameter	Veg. Sample 128	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 3N	Conc. in Tailings	Ratio Veg./Tail.
N ppm	26,800	120	223	12,590	19.5	646
P ppm	2,400	1,200	2	2,350	157	15
K ppm	29,600	25,200	1.2	16,500	10,600	1.6
Ca ppm	12,400	2,560	4.8	14,200	2,440	5.8
Mg ppm	1,100	4,640	0.2	900	5,270	0.2
Na ppm	500	16,700	0.03	200	13,800	0.01
S ppm	3,500	6,893	0.5	5,700	4,496	1.3
Se ppm	0.06	-1	=0.06	-1	-1	-1
B ppm	22	58	0.4	-	100	-
As ppm	2.1	592	0.00	4	59	0.07
Ni ppm	1.79	51	0.04	-3	-10	-0.3
Pb ppm	1.25	9	0.14	5	17	0.3
Cd ppm	-0.08	0.8	-0.1	-1	0.3	-3.3
Cr ppm	0.59	108	0.01	-5	68	-0.07
Fe ppm	60	49,600	0.00	60	15,500	0.00
Mn ppm	1,073	621	1.7	1,250	107	11.7
Cu ppm	4.1	59	0.07	9	39	0.23
Zn ppm	13	138	0.09	21	48.8	0.43
Al ppm	37	25,900	0.00	-	28,600	-
Mo ppm	0.30	1.1	0.3	-	2.1	-
Co ppm	0.33	25	0.01	-2	20	-0.10
Hg ppm	0.051	0.121	0.421	-	0.020	-
V ppm	-	118	-	-6	78	-0.08

VEGETATION: Cattail Leaves (e)
TAILINGS TYPE: Gold, (Non-Acid)
SUMMARY: VEGETATION ANALYTICAL DATA

PARAMETER	AVERAGE CONCENTRATION All Samples	RANGE All Samples		AVERAGE RATIO VEG/TAIL. All Samples
		Low	High	
N ppm	22,361	12,590	31,500	561
P ppm	1,919	1,000	2,600	7.7
K ppm	19,200	14,300	29,600	1.7
Ca ppm	10,438	7,000	14,200	4.3
Mg ppm	2,375	600	4,800	1.0
Na ppm	400	200	1,500	0.2
S ppm	3,513	1,000	5,700	0.4
Se ppm	0.08	0.02	0.15	=0.03
B ppm	27	17	37	0.4
As ppm	1.1	0.1	4	0.01
Ni ppm	6.5	1.79	15.35	=0.16
Pb ppm	2.5	0.8	5	0.1
Cd ppm	-0.08	-0.08	-1	-0.1
Cr ppm	1	0.59	2.66	0.01
Fe ppm	53	40	250	0.00
Mn ppm	784	113	1,250	=5.4
Cu ppm	5.7	3.8	9	0.07
Zn ppm	17.9	13	21	0.21
Al ppm	30.4	17	44	0.00
Mo ppm	low 0.53 high 12.3	0.30	20	0.3
Co ppm	0.7	0.33	1.33	0.02
Hg ppm	-0.049	-0.025	0.073	-0.131
V ppm	-		-	-

Note: The above data are based on 8 composite samples representing several hundred individual plants.

VEGETATION: Cattail Leaves (f)
TAILINGS TYPE: Uranium, (Non-Acid)

Parameter	Veg. Sample 107	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 52N	Conc. in Tailings	Ratio Veg./Tail.
N ppm	20,000	50.1	399	6,810	15	454
P ppm	1,500	910	1.6	550	265	2.1
K ppm	22,000	17,700	1.2	8,600	16,900	0.5
Ca ppm	9,400	374	25	15,400	26,010	0.6
Mg ppm	900	7,190	0.1	3,600	1,690	2.1
Na ppm	800	26,500	0.03	1,035	19,300	0.05
S ppm	1,900	12,754	0.2	1,600	18,100	0.09
Se ppm	0.13	-1	=0.13	-1	-0.5	-2.0
B ppm	20	84	0.2	-	-20	-
As ppm	0.2	621	0.0	3	15	0.2
Ni ppm	5.71	64	0.09	-3	24	-0.1
Pb ppm	1.88	115	0.02	2	180	0.01
Cd ppm	0.08	1.0	0.08	-1	-2	-0.5
Cr ppm	0.74	89	0.01	-5	21	-0.2
Fe ppm	40	57,100	0.00	90	30,200	0.00
Mn ppm	612	985	0.6	1,550	845	1.8
Cu ppm	9.3	39	0.2	8	50	0.2
Zn ppm	23	148	0.2	16	222	0.07
Al ppm	19	25,800	0.00	-	50,200	-
Mo ppm	0.72	1.1	0.7	-	35	-
Co ppm	0.92	17	0.05	-2	23	-0.09
Hg ppm	0.055	0.053	1.038	-	0.09	-
V ppm	-	158	-	-6	40	-0.2

VEGETATION: Cattail Leaves (g)
TAILINGS TYPE: Uranium, (Non-Acid)

Parameter	Veg. Sample 50N	Conc. in Tailings	Ratio Veg./Tail.
N ppm	27,000	70	386
P ppm	3,200	115	28
K ppm	35,800	11,500	3.1
Ca ppm	24,400	29,100	0.8
Mg ppm	1,200	170	7.1
Na ppm	327	300	1.1
S ppm	3,700	19,280	0.2
Se ppm	-1	-0.5	-2.0
B ppm	-	-20	-
As ppm	3	20	0.2
Ni ppm	-3	2	-1.5
Pb ppm	14	625	0.02
Cd ppm	-1	-2	-0.5
Cr ppm	-5	29	-0.2
Fe ppm	110	22,700	0.00
Mn ppm	400	10	40
Cu ppm	8	43	0.2
Zn ppm	24	37	0.6
Al ppm	-	37,400	-
Mo ppm	-	15	-
Co ppm	-2	20	-0.1
Hg ppm	-	0.04	-
V ppm	-6	35	-0.2

VEGETATION: Cattail Leaves (h)
TAILINGS TYPE: Sulphide (Acid) (Cu, Ni, Pb, Zn)

Parameter	Veg. Sample 112	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 8	Conc. in Tailings
N ppm	32,000	47.4	675	20,000	
P ppm	2,300	330	7.0	1,800	N/A
K ppm	42,700	16,700	2.6	24,500	N/A
Ca ppm	17,200	2,370	7.3	8,500	
Mg ppm	800	5,730	0.1	1,100	
Na ppm	1,100	18,700	0.06	200	
S ppm	3,800	13,410	0.3	2,700	
Se ppm	22	68	0.3	0.58	
B ppm	21	100	0.2	18	
As ppm	0.4	1,010	0.00	8.40	
Ni ppm	0.7	90	0.01	78.54	
Pb ppm	1.88	1,293	0.00	10.63	
Cd ppm	0.17	14.4	0.01	0.42	
Cr ppm	0.88	89	0.01	1.47	
Fe ppm	120	136,000	0.00	180	
Mn ppm	1,248	188	6.6	785	
Cu ppm	10.3	945	0.01	30.1	
Zn ppm	53	1,660	0.03	19	
Al ppm	230	36,500	0.01	58	
Mo ppm	0.31	2.8	0.1	0.53	
Co ppm	0.75	160	0.00	0.50	
Hg ppm	0.037	0.283	0.131	-	
V ppm	-	40	-	-	

VEGETATION: Cattail Leaves (i)
TAILINGS TYPE: Sulphide (Acid) (Cu, Ni, Pb, Zn)

Parameter	Veg. Sample 31N	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 100	Conc. in Tailings	Ratio Veg./Tail.
N ppm	6,670	55.5	120	32,500	92.0	353
P ppm	1,110	247	4.5	2,900	185	16
K ppm	1,300	896	1.5	21,800	1,290	17
Ca ppm	6,400	1,790	3.6	8,000	8,460	0.9
Mg ppm	1,600	17,600	0.09	4,000	34,500	0.1
Na ppm	-4	99.6	-0.04	800	4,680	0.2
S ppm	5,900	6,693	0.9	7,000	67,732	0.1
Se ppm	-1	4	-0.3	0.16	2	0.08
B ppm	-	88	-	30	435	0.07
As ppm	-1	239	-0.00	7.8	249	0.03
Ni ppm	-3	2,720	-0.00	4.28	78	0.05
Pb ppm	8	27	0.3	1.25	53	0.02
Cd ppm	-1	2.1	-0.5	-0.08	3.8	-0.02
Cr ppm	-5	1,040	-0.00	5	756	0.01
Fe ppm	440	53,300	0.01	680	255,000	0.00
Mn ppm	-50	867	-0.06	1,140	806	1.4
Cu ppm	6	2,020	0.00	4.2	677	0.01
Zn ppm	64	69.7	0.9	37	1,274	0.03
Al ppm	-	7,270	-	35	8,360	0.00
Mo ppm	-	-0.6	-	0.14	2.2	0.06
Co ppm	-2	145	-0.01	0.58	70	0.01
Hg ppm	-	0.071	-	0.036	0.604	0.060
V ppm	-6	159	-0.04	-	119	-

VEGETATION: Cattail Leaves (j)
TAILINGS TYPE: Sulphide (Acid) (Cu, Ni, Pb, Zn)
SUMMARY: VEGETATION ANALYTICAL DATA

PARAMETER	AVERAGE CONCENTRATION All Samples	RANGE All Samples Low	High	AVERAGE RATIO VEG/TAIL. All Samples
N ppm	22,793	6,670	32,500	383
P ppm	2,028	1,110	2,900	9
K ppm	22,575	1,300	42,200	2.1
Ca ppm	10,025	6,400	17,200	3.9
Mg ppm	1,875	800	4,000	0.1
Na ppm	700	-4	1,100	-0.1
S ppm	4,850	2,700	7,000	0.4
Se ppm	-0.6	0.16	22	0.2
B ppm	23	18	30	0.1
As ppm	-4.4	0.4	8.40	-0.01
Ni ppm	-2.7	0.7	78.54	0.02
Pb ppm	5.4	1.25	10.63	0.1
Cd ppm	-0.4	-0.08	-1	-0.2
Cr ppm	-3.1	0.88	5	-0.01
Fe ppm	355	120	680	0.00
Mn ppm	-806	-50	1,248	-2.7
Cu ppm	12.7	4.2	30.1	0.01
Zn ppm	43.3	19	64	0.3
Al ppm	108	35	230	0.01
Mo ppm	0.3	0.14	0.53	0.08
Co ppm	-1.0	0.50	-2	-0.01
Hg ppm	0.037	0.036	0.037	0.096
V ppm	insuff. data			

Note: The above data are based on 4 composite vegetation samples representing less than 100 plants.

VEGETATION: Cattail Leaves (k)
TAILINGS TYPE: Sulphide (Non Acid) (Cu)

Parameter	Veg. Sample 35	Conc. in Tailings	Ratio Veg./Tail.
N ppm	10,500	24	438
P ppm	600	229	2.6
K ppm	17,200	15,750	1.1
Ca ppm	11,600	4,075	2.8
Mg ppm	1,200	302	4.0
Na ppm	500	11,030	0.05
S ppm	3,900	14,069	0.3
Se ppm	0.12	5	0.02
B ppm	19	102	0.2
As ppm	0.30	201	0.00
Ni ppm	3.57	-10	=0.36
Pb ppm	2.5	43	0.06
Cd ppm	-0.08	0.9	-0.09
Cr ppm	1.32	93	0.01
Fe ppm	260	44,200	0.01
Mn ppm	530	422	1.3
Cu ppm	9.3	549	0.02
Zn ppm	19	152	0.1
Al ppm	81	32,450	0.00
Mo ppm	15	2.2	6.8
Co ppm	0.83	54	0.02
Hg ppm	0.062	0.046	1.348
V ppm	-	99	-

VEGETATION: Cattail Leaves (1)
TAILINGS TYPE: Silver (Arsenic)

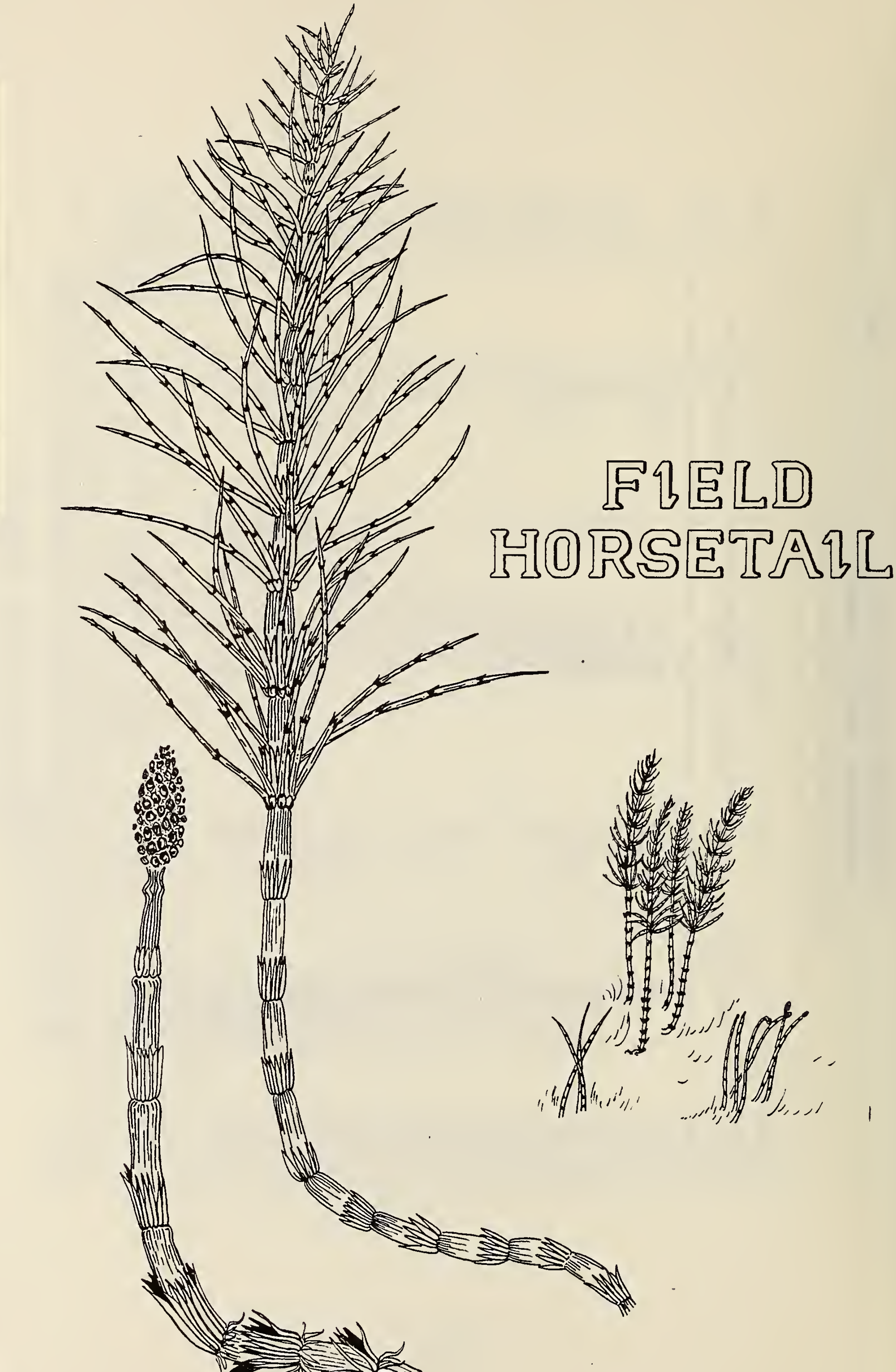
Parameter	Veg. Sample 76	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 12N	Conc. in Tailings	Ratio Veg./Tail.
N ppm	20,500	42	488	22,780	14.0	1627
P ppm	1,300	524	2.5	1,200	475	2.5
K ppm	20,000	10,625	1.9	22,600	6,270	3.6
Ca ppm	8,700	4,965	1.8	18,500	4,190	4.4
Mg ppm	1,000	10,225	0.1	5,200	14,400	0.4
Na ppm	200	8,050	0.02	95	31,200	0.00
S ppm	3,100	5,345	0.6	6,400	2,001	3.2
Se ppm	0.05	2	0.03	-1	-1	-1
B ppm	29	81	0.4	-	145	-
As ppm	6.00	7,665	0.00	1	652	0.00
Ni ppm	5.36	190	0.03	-3	63	-0.05
Pb ppm	1.00	27	0.04	16	33	0.5
Cd ppm	-0.08	1.2	-0.07	-1	1.9	-0.5
Cr ppm	1.17	238	0.00	-5	369	-0.01
Fe ppm	40	57,550	0.00	310	40,900	0.01
Mn ppm	435	1,054	0.4	50	360	0.1
Cu ppm	3.7	112	0.03	15	175	0.09
Zn ppm	13	107	0.1	75	282	0.3
Al ppm	36	19,900	0.00	-	50,000	-
Mo ppm	76.3	1.4	55	-	-0.6	-
Co ppm	2.83	363	0.10	-2	142	-0.01
Hg ppm	0.036	0.972	0.037	-	0.288	-
V ppm	-	181	-	-6	156	-0.04

VEGETATION: Cattail Leaves (m)
BACKGROUND SAMPLES SUMMARY
Paleozoic Bedrock: Southern Ontario

PARAMETER	AVERAGE CONCENTRATION (All Samples)
N ppm	21,750
P ppm	1,900
K ppm	17,100
Ca ppm	15,000
Mg ppm	1,800
Na ppm	1,100
S ppm	1,300
Se ppm	0.07
B ppm	21.5
As ppm	0.06
Ni ppm	1.43
Pb ppm	3.28
Cd ppm	-0.08
Cr ppm	0.74
Fe ppm	60
Mn ppm	552
Cu ppm	7.0
Zn ppm	24
Al ppm	51
Mo ppm	1.5
Co ppm	-0.47
Hg ppm	0.069

Note: Data based on two composite samples only representing less than 100 individual plants.

FIELD HORSETAIL



VEGETATION: Field Horsetail (a)
TAILINGS TYPE: Gold (Non Acid)

Parameter	Veg. Sample 44	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 56	Conc. in Tailings	Ratio Veg./Tail.
N ppm	21,500	27.8	773	10,500	313	34
P ppm	2,100	261	8	1,100	238	5
K ppm	23,800	1,170	20	11,800	9,210	1.3
Ca ppm	21,200	486	44	14,600	99	147
Mg ppm	12,700	2,330	6	4,500	1,190	4
Na ppm	800	875	0.9	300	1,490	0.2
S ppm	1,700	8,991	0.2	800	33,966	0.02
Se ppm	0.12	5	0.02	0.16	12	0.01
B ppm	37	82	0.5	68	77	0.9
As ppm	6.70	1,310	0.01	0.40	386	0.00
Ni ppm	2.86	-10	=0.29	2.86	386	0.01
Pb ppm	1.88	3,160	0.00	-	646	-
Cd ppm	1.17	18.3	0.06	0.08	51	0.00
Cr ppm	1.18	39	0.03	0.88	109	0.01
Fe ppm	340	348,000	0.00	820	370,000	0.00
Mn ppm	96	97	1	45	-10	=4.5
Cu ppm	6.5	1,860	0.0	8.4	1,820	0.01
Zn ppm	56	4,070	0.01	99	99	1
Al ppm	62	4,090	0.02	69	11,100	0.01
Mo ppm	0.51	-0.6	=0.9	20	55	0.36
Co ppm	1.83	74	0.02	2.08	463	0.00
Hg ppm	0.058	0.017	3.412	-0.025	9.46	-0.00
V ppm	-	28	-	-	119	

VEGETATION: Field Horsetail (b)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 60	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 64	Conc. in Tailings	Ratio Veg./Tail.
N ppm	12,500	55.7	224	14,000	100	140
P ppm	900	815	1.1	1,300	1,200	1.1
K ppm	12,800	34,700	0.37	14,000	8,590	1.6
Ca ppm	21,100	2,700	7.8	19,400	2,730	7.1
Mg ppm	8,400	4,920	1.7	9,300	4,100	2.3
Na ppm	1,100	23,000	0.05	200	24,400	0.01
S ppm	13,000	105,894	0.12	7,200	18,881	0.38
Se ppm	0.06	10	0.01	0.04	3	0.10
B ppm	27	76	0.36	32	53	0.60
As ppm	0.20	116	0.00	186	5,530	0.03
Ni ppm	1.79	25	0.07	5	101	0.05
Pb ppm	3.13	26	0.12	4.06	-1	=4.1
Cd ppm	0.17	0.6	0.3	-0.08	0.6	-0.1
Cr ppm	1.17	87	0.01	0.74	59	0.01
Fe ppm	330	34,200	0.01	1,100	48,700	0.02
Mn ppm	69	338	0.20	168	937	0.18
Cu ppm	6.2	106	0.06	4.7	29	0.16
Zn ppm	37	77.1	0.48	80	68.3	1.2
Al ppm	57	45,200	0.00	53	30,000	0.00
Mo ppm	8.80	7.5	1.2	0.22	-0.6	=0.4
Co ppm	1.42	27	0.05	1.83	47	0.04
Hg ppm	0.044	2.27	0.02	0.051	0.171	0.30
V ppm	-6	138	-0.04	-	312	-

VEGETATION: Field Horsetail (c)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 65	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 80	Conc. in Tailings	Ratio Veg./Tail.
N ppm	16,500	83.4	198	12,500	313	40
P ppm	1,200	514	2.3	1,200	238	5
K ppm	11,600	5,950	1.9	21,800	9,210	2.4
Ca ppm	16,000	4,890	3.3	19,700	99	199
Mg ppm	21,100	11,100	1.9	1,900	1,190	1.6
Na ppm	500	16,300	0.03	800	1,490	0.54
S ppm	-13,000	18,248	-0.7	6,200	33,966	0.18
Se ppm	0.06	4	0.02	0.13	12	0.01
B ppm	40	92	0.4	31	77	0.40
As ppm	38.0	825	0.05	0.33	386	0.00
Ni ppm	-	399	-	2.14	386	0.01
Pb ppm	4.06	14	0.29	1.25	646	0.00
Cd ppm	-0.08	0.9	-0.09	-0.08	51	-0.00
Cr ppm	1.47	566	0.00	0.88	109	0.01
Fe pmm	1,180	66,500	0.02	140	370,000	0.00
Mn ppm	146	1,360	0.11	182	-10	=18
Cu ppm	7.1	173	0.0	4.3	1,820	0.00
Zn ppm	69	355	0.19	53	99	0.54
Al ppm	65	9,310	0.01	45	11,100	0.00
Mo ppm	0.49	3,416	0.00	36.3	55	0.66
Co ppm	4.25	37	0.11	2.33	463	0.01
Hg ppm	0.042	0.198	0.212	0.029	9.46	0.00
V ppm	-	269	-	-	119	-

VEGETATION: Field Horsetail (d)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 84	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 88	Conc. in Tailings	Ratio Veg./Tail.
N ppm	12,000	61.2	196	21,500	92.3	233
P ppm	1,000	776	1.3	1,600	673	2.4
K ppm	15,900	35,000	0.5	24,900	38,800	0.6
Ca ppm	41,000	2,630	15.6	44,000	2,780	15.8
Mg ppm	12,500	5,160	2.4	11,500	5,940	1.9
Na ppm	400	22,000	0.02	800	18,400	0.04
S ppm	-13,000	11,355	-1.1	-13,000	8,392	-1.5
Se ppm	0.02	-1	=0.02	0.05	-1	=0.05
B ppm	46	102	0.5	45	79	0.6
As ppm	0.18	117	0.00	0.22	115	0.00
Ni ppm	3.57	-10	=0.36	6.43	75	0.09
Pb ppm	4.06	11	0.37	1.88	18	0.10
Cd ppm	-0.08	0.6	-0.1	-0.08	0.6	-0.1
Cr ppm	1.47	107	0.01	1.47	182	0.01
Fe ppm	740	33,400	0.02	240	31,300	0.01
Mn ppm	369	379	0.97	90	460	0.20
Cu ppm	6.3	78	0.1	5.3	38	0.1
Zn ppm	40	87.5	0.5	35	105	0.3
Al ppm	71	41,700	0.00	41	39,100	0.00
Mo ppm	25	4.3	5.8	12.30	3.6	3.4
Co ppm	1.58	14	0.11	1.42	13	0.11
Hg ppm	-	0.201	-	0.047	1.24	0.038
V ppm	-	195	-	-6	137	-0.04

VEGETATION: Field Horsetail (e)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 91	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 93	Conc. in Tailings	Ratio Veg./Tail.
N ppm	9,500	22.3	426	9,000	14	643
P ppm	900	1,440	0.6	700	1,560	0.45
K ppm	14,700	42,400	0.3	10,800	38,100	0.28
Ca ppm	35,000	3,840	9.1	30,000	3,430	8.7
Mg ppm	11,400	8,970	1.3	9,100	8,770	1.04
Na ppm	500	14,000	0.04	400	17,600	0.02
S ppm	-13,000	4,662	-2.8	-13,000	6,960	-1.9
Se ppm	0.05	2	0.03	0.11	4	0.03
B ppm	42	100	0.42	47	101	0.47
As ppm	0.36	39	0.01	0.20	562	0.00
Ni ppm	4.64	-10	=0.46	4.28	-10	=0.43
Pb ppm	4.70	9	0.52	3.78	9	0.42
Cd ppm	0.16	0.6	0.3	0.08	0.6	0.1
Cr ppm	2.05	157	0.01	2.21	124	0.02
Fe ppm	1,440	49,200	0.03	1,440	47,000	0.03
Mn ppm	323	611	0.54	422	648	0.65
Cu ppm	7.8	99	0.08	7.1	76	0.09
Zn ppm	52	108	0.48	45	200	0.23
Al ppm	84	29,500	0.00	77	33,800	0.00
Mo ppm	20	5.5	3.6	70	1.6	43.8
Co ppm	3.25	35	0.09	3.17	13	0.24
Hg ppm	-0.025	0.318	-0.08	-	3.76	-
V ppm	-	158	-	-	114	-

VEGETATION: Field Horsetail (f)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 120	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 127	Conc. in Tailings	Ratio Veg./Tail.
N ppm	16,500	19.5	846	21,000	120	175
P ppm	1,100	157	7	1,700	1,200	1.4
K ppm	23,200	10,600	2.2	32,200	25,200	1.3
Ca ppm	48,000	2,440	19.7	46,000	2,560	18.0
Mg ppm	2,300	5,270	0.44	9,100	4,640	1.96
Na ppm	1,500	13,800	0.11	800	16,700	0.05
S ppm	-13,000	4,496	-2.89	-13,000	6,893	-1.89
Se ppm	-0.02	-1	-0.02	0.03	-1	=0.03
B ppm	27	100	0.27	28	58	0.48
As ppm	0.10	59	0.00	2.90	592	0.00
Ni ppm	7.85	-10	=0.79	1.79	51	0.04
Pb ppm	5.00	17	0.29	3.13	9	0.35
Cd ppm	-0.08	0.3	-0.3	-0.08	0.8	-0.1
Cr ppm	1.76	68	0.03	0.74	108	0.01
Fe ppm	380	15,500	0.02	120	49,600	0.00
Mn ppm	180	107	1.7	381	621	0.6
Cu ppm	5.5	39	0.1	5.6	59	0.1
Zn ppm	32	48.8	0.7	52	138	0.4
Al ppm	111	28,600	0.00	40	25,900	0.00
Mo ppm	1.50	2.1	0.7	1.70	1.1	1.5
Co ppm	0.96	20	0.05	1.75	25	0.07
Hg ppm	-0.025	0.020	-1.25	0.080	0.121	0.66
V ppm	-	78	-	-	118	-

VEGETATION: Field Horsetail (g)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 130	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 171	Conc. in Tailings	Ratio Veg./Tail.
N ppm	15,000	61.4	244	11,000	55.9	197
P ppm	1,200	890	1.3	900	1,700	0.5
K ppm	14,300	29,700	0.48	5,000	5,890	0.85
Ca ppm	12,800	2,370	5.4	22,800	3,240	7.0
Mg ppm	7,000	4,550	1.5	1,700	4,910	0.30
Na ppm	300	9,990	0.03	400	28,500	0.01
S ppm	1,400	15,385	0.09	800	16,051	0.05
Se ppm	0.04	6	0.01	0.01	-1	=0.01
B ppm	19	72	0.26	49	100	0.49
As ppm	4.0	752	0.01	420	11,600	0.04
Ni ppm	2.14	64	0.03	2.50	25	0.10
Pb ppm	1.30	64	0.02	2.50	4	0.63
Cd ppm	-0.08	1.0	-0.1	-0.08	1.3	-0.1
Cr ppm	1.03	129	0.01	1.00	128	0.01
Fe ppm	420	66,800	0.01	1,802	58,400	0.03
Mn ppm	75	940	0.08	98	383	0.26
Cu ppm	4.9	168	0.03	5.0	128	0.04
Zn ppm	97	109	0.89	45	78.5	0.57
Al ppm	61	27,000	0.00	40	37,200	0.00
Mo ppm	0.18	1.1	0.2	0.28	-0.6	=0.5
Co ppm	1.25	61	0.02	2.08	87	0.02
Hg ppm	-	1.11	-	0.033	1.56	0.02
V ppm	-	119	-	-	118	-

VEGETATION: Field Horsetail (h)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 173	Conc. in Tailings	Ratio Veg./Tail.
N ppm	12,000	322	37
P ppm	1,300	1,320	1
K ppm	9,700	10,600	0.9
Ca ppm	15,400	2,520	6
Mg ppm	2,400	5,910	0.4
Na ppm	200	7,550	0.03
S ppm	800	4,595	0.17
Se ppm	0.02	2	0.01
B ppm	23	102	0.23
As ppm	37.0	13,300	0.00
Ni ppm	2.83	38	0.07
Pb ppm	1.40	25	0.06
Cd ppm	0.15	0.8	0.2
Cr ppm	1.30	87	0.01
Fe ppm	138	39,300	0.00
Mn ppm	55	261	0.21
Cu ppm	3.0	106	0.03
Zn ppm	109	155	0.70
Al ppm	15	28,600	0.00
Mo ppm	0.19	-0.6	=0.3
Co ppm	1.08	16	0.07
Hg ppm	0.040	0.714	0.056
V ppm	-6	77	-0.08

VEGETATION: Field Horsetail (i)
TAILINGS TYPE: Gold (Non-Acid)
SUMMARY: VEGETATION ANALYTICAL DATA

PARAMETER	AVERAGE CONCENTRATION All Samples	RANGE All Samples		AVERAGE RATIO VEG/TAIL. All Samples
		Low	High	
N ppm	14,333	9,000	21,500	294
P ppm	1,213	700	2,100	2.6
K ppm	16,433	5,000	32,200	1.1
Ca ppm	27,133	12,800	48,000	13
Mg ppm	8,327	1,700	21,100	1.9
Na ppm	600	200	1,500	0.14
S ppm	-8,193	800	-13,000	-0.9
Se ppm	-0.06	0.01	0.16	-0.02
B ppm	37	19	68	0.5
As ppm	low: 0.25 high: variable	0.10	420	0.01
Ni ppm	3.62	1.79	7.85	-0.20
Pb ppm	3.00	1.25	5.00	0.24
Cd ppm	-0.17	-0.08	1.17	-0.1
Cr ppm	1.29	0.74	2.21	0.01
Fe ppm	709	120	1,802	0.01
Mn ppm	180	45	422	0.5
Cu ppm	5.8	3.0	8.4	0.1
Zn ppm	60	32	109	0.5
Al ppm	59	15	111	0.00
Mo ppm	low: 0.63 high: 29	0.18	70	-1.4
Co ppm	2.02	0.96	4.25	0.07
Hg ppm	-0.042	-0.025	0.080	-0.14
V ppm	-6		-	-0.05

Note: Above data based on 15 composite samples composed of a total of several hundred individual plants. Vanadium is an exception. Vanadium data based on only three composite samples representing less than 100 individual plants.

VEGETATION: Field Horsetail (j)
TAILINGS TYPE: Silver (Arsenic-bearing) Non-Acid

Parameter	Veg. Sample 727375	Conc. in Tailings	Ratio Veg./Tail.
N ppm	18,000	42	429
P ppm	1,500	524	2.9
K ppm	28,733	10,625	2.7
Ca ppm	17,433	4,965	3.5
Mg ppm	1,600	10,225	0.2
Na ppm	433	8,050	0.05
S ppm	5,866	5,345	1.1
Se ppm	-0.04	2	-0.02
B ppm	36	81	0.4
As ppm	176	7,665	0.02
Ni ppm	8	190	0.04
Pb ppm	1.3	27	0.05
Cd ppm	-0.08	1.2	-0.07
Cr ppm	1	238	0.00
Fe ppm	90	57,550	0.00
Mn ppm	94	1,054	0.09
Cu ppm	4.4	112	0.04
Zn ppm	25	107	0.23
Al ppm	37	19,900	0.00
Mo ppm	31.3	1.4	22.4
Co ppm	24	363	0.07
Hg ppm	0.064	0.972	0.066
V ppm	-	181	-

Note: The above data is based on 3 composite samples representing less than 150 individual plants. All samples were from various locations on the same property.

VEGETATION: Field Horsetail (k)
TAILINGS TYPE: Acid Sulphides (Cu/Pb/Zn/Pt)

Parameter	Veg. Sample 114	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 28N	Conc. in Tailings	Ratio Veg./Tail.	Average Ratio Veg./Tail.
N ppm	16,500	47.4	348	11,730	55.5	211	280
P ppm	1,300	330	3.9	800	247	3.2	3.6
K ppm	22,200	16,700	1.3	16,900	896	19	-
Ca ppm	25,300	2,370	11	31,500	1,790	17.6	14.3
Mg ppm	1,400	5,730	0.2	10,400	17,600	0.6	0.4
Na ppm	600	18,700	0.03	32	99.6	0.3	0.2
S ppm	3,000	13,410	0.2	13,600	6,693	2	1.1
Se ppm	16	68	0.2	-1	4	-0.3	-0.3
B ppm	21	100	0.2	-	88	-	-
As ppm	0.11	1,010	0.00	3	239	0.01	0.01
Ni ppm	1.43	90	0.02	113	2,720	0.04	0.03
Pb ppm	4.38	1,293	0.00	8	27	0.3	0.2
Cd ppm	-0.08	14.4	-0.01	-1	2.1	-0.5	-0.3
Cr ppm	1.03	89	0.01	5	1,040	0.00	0.01
Fe ppm	300	136,000	0.00	700	53,300	0.01	0.01
Mn ppm	75	188	0.4	50	867	0.06	0.2
Cu ppm	13.1	945	0.01	27	2,020	0.01	0.01
Zn ppm	274	1,660	0.2	22	69.7	0.3	0.3
Al ppm	133	36,500	0.00	-	7,270	-	-
Mo ppm	0.14	2.8	0.05	-	-0.6	-	-
Co ppm	1.58	160	0.01	-2	145	-0.01	-0.01
Hg ppm	-0.025	0.283	-0.088	-	0.071	-	-
V ppm	-	40	-	-6	159	-0.04	-

Note: Average ratio based on two composite samples only representing less than 100 individual plants.

VEGETATION: Field Horsetail (1)
TAILINGS TYPE: Uranium (Non-Acid)

Parameter	Veg. Sample 104	Conc. in Tailings	Ratio Veg./Tail.
N ppm	15,500	50.1	309
P ppm	1,500	910	1.6
K ppm	27,400	17,700	1.5
Ca ppm	38,000	374	102
Mg ppm	4,600	7,190	0.6
Na ppm	500	26,500	0.02
S ppm	12,000	12,754	0.94
Se ppm	0.02	-1	=0.02
B ppm	32	84	0.4
As ppm	0.40	621	0.00
Ni ppm	1.79	64	0.03
Pb ppm	8.75	115	0.08
Cd ppm	-0.08	1.0	-0.08
Cr ppm	1.18	89	0.01
Fe ppm	190	57,100	0.00
Mn ppm	90	985	0.09
Cu ppm	5.2	39	0.13
Zn ppm	32	148	0.22
Al ppm	98	25,800	0.00
Mo ppm	1.05	1.1	1
Co ppm	1.17	17	0.07
Hg ppm	0.045	0.053	0.849
V ppm	-	158	-

Note: Data based on one composite sample only and representing less than 50 individual plants.

VEGETATION: Field Horsetail (m)
TAILINGS TYPE: Uranium (Non-Acid)

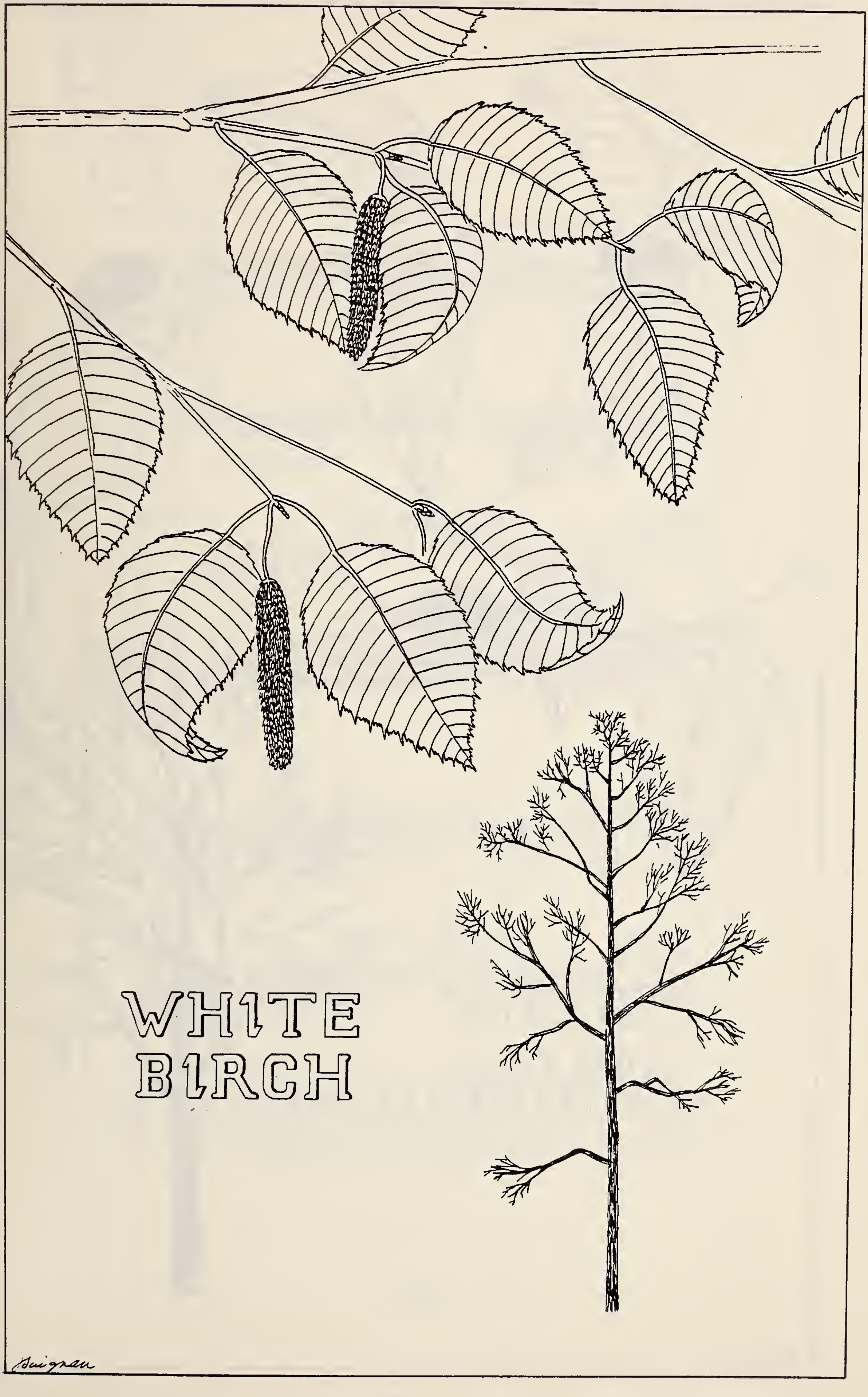
Parameter	Veg. Sample 3436	Conc. in Tailings	Ratio Veg./Tail.
N ppm	15,500	24	646
P ppm	1,100	229	4.8
K ppm	13,900	15,750	0.9
Ca ppm	34,000	4,075	8.3
Mg ppm	2,900	302	9.6
Na ppm	400	11,030	0.04
S ppm	13,000	14,069	0.9
Se ppm	0.06	5	0.01
B ppm	33	102	0.3
As ppm	16	201	0.08
Ni ppm	4.64	-10	=0.5
Pb ppm	3.44	43	0.08
Cd ppm	-0.08	0.9	-0.1
Cr ppm	1.76	93	0.02
Fe ppm	780	44,200	0.02
Mn ppm	108	422	0.3
Cu ppm	27	549	0.1
Zn ppm	42	152	0.3
Al ppm	29	32,450	0.0
Mo ppm	15	2.2	6.8
Co ppm	4.25	54	0.08
Hg ppm	0.073	0.046	1.587
V ppm	-	99	-

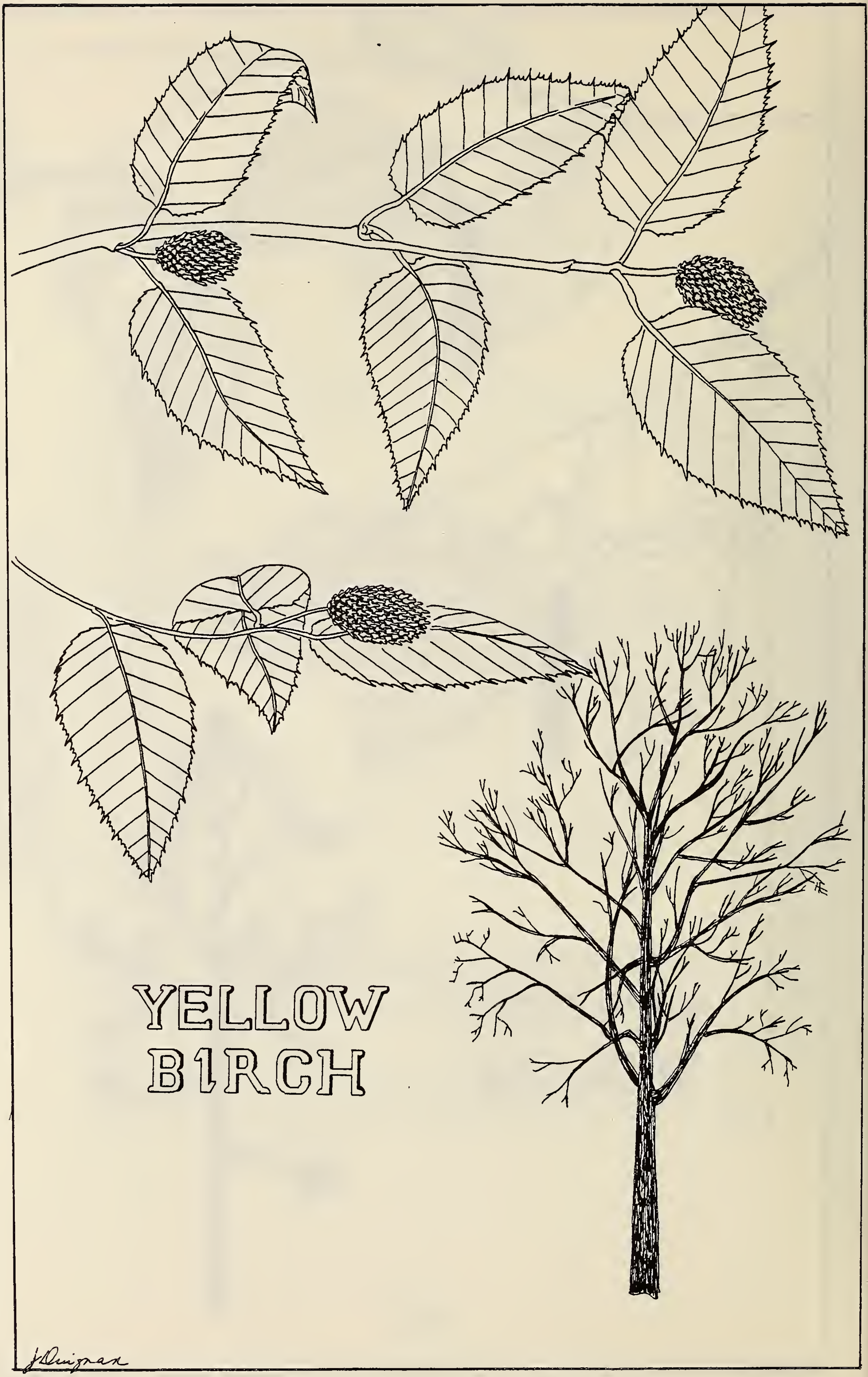
Note: Data based on one composite sample representing less than 50 individual plants.

VEGETATION: Field Horsetail (n)
BACKGROUND SAMPLES SUMMARY
Paleozoic Bedrock: Southern Ontario

PARAMETER	AVERAGE CONCENTRATION (All Samples)
N ppm	24,000
P ppm	2,600
K ppm	27,900
Ca ppm	38,500
Mg ppm	7,500
Na ppm	400
S ppm	-13,000
Se ppm	0.03
B ppm	37
As ppm	0.15
Ni ppm	0.71
Pb ppm	3.58
Cd ppm	0.17
Cr ppm	1.18
Fe ppm	80
Mn ppm	130
Cu ppm	8.5
Zn ppm	Not available
Al ppm	53
Mo ppm	Not available
Co ppm	0.71
Hg ppm	0.082
V ppm	Not available

Note: Data based on two composite samples only representing less than 100 individual plants.


WHITE
BIRCH



YELLOW BIRCH

VEGETATION: Birch (leaves) (a)
TAILINGS TYPE: Gold, (Non-Acid)

Parameter	Veg. Sample 62	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 86	Conc. in Tailings	Ratio Veg./Tail.
N ppm	22,000	100	220	11,000	66.8	165
P ppm	1,100	1,200	0.9	1,600	1,030	1.6
K ppm	7,300	8,590	0.8	8,500	42,200	0.2
Ca ppm	12,000	2,730	4.4	20,600	3,170	6.5
Mg ppm	7,300	4,100	1.8	8,800	6,430	1.4
Na ppm	300	24,400	0.01	300	17,800	0.02
S ppm	2,500	18,881	0.1	2,500	4,729	0.5
Se ppm	0.08	3	0.03	0.04	-1	=0.04
B ppm	42	53	0.8	34	104	0.3
As ppm	20	5,530	0.00	0.28	77	0.00
Ni ppm	6.7	101	0.1	10.35	-10	=1.04
Pb ppm	3.38	-1	=3.4	4.69	11	0.43
Cd ppm	3.17	0.6	5.3	0.33	0.3	1.1
Cr ppm	0.74	59	0.01	0.88	144	0.01
Fe ppm	200	48,700	0.00	65	35,800	0.00
Mn ppm	129	937	0.1	425	403	1.05
Cu ppm	7.3	29	0.3	7.5	106	0.07
Zn ppm	319	68.3	4.7	644	76.8	8.4
Al ppm	46	30,000	0.00	41	39,200	0.00
Mo ppm	0.91	-0.6	=1.52	81.3	6.4	12.7
Co ppm	0.92	47	0.02	6.08	11	0.55
Hg ppm	0.055	0.171	0.322	0.044	0.007	6.286
V ppm	----	312	---	---	154	---

VEGETATION: Birch (leaves) (b)
TAILINGS TYPE: Gold, (Non-Acid)

Parameter	Veg. Sample 98	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 131	Conc. in Tailings	Ratio Veg./Tail.
N ppm	10,500	313	33.5	36,000	61.4	586
P ppm	2,100	238	8.8	1,500	890	1.7
K ppm	14,200	9,210	1.5	7,500	29,700	0.3
Ca ppm	28,000	99	283	12,300	2,370	5.2
Mg ppm	8,700	1,190	7.3	4,100	4,550	0.9
Na ppm	400	1,490	0.3	300	9,990	0.03
S ppm	8,000	33,966	0.2	1,900	15,385	0.1
Se ppm	0.04	12	0.00	0.06	6	0.01
B ppm	230	77	3.0	28	72	0.4
As ppm	0.20	386	0.00	0.46	752	0.00
Ni ppm	4.28	386	0.01	2.14	64	0.03
Pb ppm	8.13	646	0.01	5.63	64	0.09
Cd ppm	1.00	51	0.02	0.08	1.0	0.08
Cr ppm	1.03	109	0.01	0.74	129	0.01
Fe ppm	300	370,000	0.00	80	66,800	0.00
Mn ppm	210	-10	=21	126	940	0.1
Cu ppm	6.5	1,820	0.00	11.9	168	0.07
Zn ppm	789	99	8.0	37	109	0.3
Al ppm	37	11,100	0.00	46	27,000	0.00
Mo ppm	7.5	55	0.1	2.44	1.1	2.2
Co ppm	10.73	463	0.02	0.99	61	0.02
Hg ppm	0.371	9.46	0.04	0.135	1.11	0.122
V ppm	---	119	---	---	119	---

VEGETATION: Birch (leaves) (c)
TAILINGS TYPE: Gold, (Non-Acid)

Parameter	Veg. Sample 164	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 165	Conc. in Tailings	Ratio Veg./Tail.
N ppm	20,00	115	174	20,000	36.4	549
P ppm	3,100	1,970	1.6	1,000	1,040	0.96
K ppm	15,200	896	17	2,600	893	2.9
Ca ppm	9,700	6,070	1.6	11,600	6,650	1.7
Mg ppm	2,600	8,160	0.3	4,700	14,800	0.3
Na ppm	100	1,090	0.09	200	793	0.3
S ppm	1,100	23,210	0.05	400	5,195	0.08
Se ppm	0.03	3	0.01	0.04	10	0.00
B ppm	38	104	0.4	47	106	0.4
As ppm	4.00	9,750	0.00	32.00	3,890	0.01
Ni ppm	2.50	-10	=0.3	2.67	-10	=0.27
Pb ppm	1.00	30	0.03	2.00	140	0.01
Cd ppm	0.23	2.5	0.09	-0.08	2.5	-0.03
Cr ppm	0.70	129	0.01	0.90	188	0.00
Fe ppm	117	206,000	0.00	572	233,000	0.00
Mn ppm	335	408	0.8	658	1,150	0.6
Cu ppm	8	100	0.08	20	109	0.2
Zn ppm	400	259	1.5	50	228	0.2
Al ppm	15	10,900	0.00	65	12,600	0.01
Mo ppm	0.20	-0.6	=0.3	0.19	-0.6	=0.3
Co ppm	1.17	8	0.15	1.58	6	0.3
Hg ppm	0.036	0.235	0.153	0.029	0.061	0.475
V ppm	---	80	---	---	-40	---

VEGETATION: Birch (leaves) (d)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 166	Conc. in Tailings	Ratio Veg./Tail.
N ppm	22,000	75.5	291
P ppm	1,100	2,220	0.5
K ppm	1,700	1,990	0.9
Ca ppm	13,600	3,570	3.8
Mg ppm	3,200	11,000	0.3
Na ppm	200	2,480	0.08
S ppm	1,400	30,070	0.05
Se ppm	0.04	8	0.01
B ppm	45	103	0.4
As ppm	480.0	5,840	0.08
Ni ppm	3.75	-10	=0.38
Pb ppm	10	96	0.1
Cd ppm	-0.08	2.6	-0.03
Cr ppm	1.20	79	0.02
Fe ppm	2,116	194,000	0.01
Mn ppm	717	377	1.9
Cu ppm	16	149	0.1
Zn ppm	62	139	0.4
Al ppm	275	16,100	0.02
Mo ppm	0.21	-0.6	=0.4
Co ppm	1.50	3	0.5
Hg ppm	0.018	0.046	0.391
V ppm	---	80	---

VEGETATION: Birch (leaves) (e)
TAILINGS TYPE: Gold (Non-Acid)
SUMMARY: VEGETATION ANALYTICAL DATA

PARAMETER	AVERAGE CONCENTRATION All Samples	RANGE All Samples Low	High	AVERAGE RATIO VEG/TAIL. All Samples
N ppm	20,214	10,500	36,000	295
P ppm	1,643	1,000	3,100	1.2
K ppm	8.143	1,700	15,200	1.1
Ca ppm	15,400	9,700	28,000	3.9
Mg ppm	7,114	2,600	13,600	1.4
Na ppm	257	100	400	0.1
S ppm	1,400	400	8,000	0.2
Se ppm	0.05	0.03	0.08	-0.01
B ppm	39	28	230	0.5
As ppm	variable	0.20	480	0.01
Ni ppm	4.6	2.14	10.35	-0.2
Pb ppm	5.0	1.00	10	0.1
Cd ppm	-0.3	-0.08	3.17	-0.2
Cr ppm	0.9	0.70	1.20	0.01
Fe ppm	222	65	2,116	0.00
Mn ppm	371	126	717	0.8
Cu ppm	11	6.5	20	0.1
Zn ppm	329	37	789	3.4
Al ppm	42	15	275	0.00
Mo ppm	variable	0.19	81.3	variable
Co ppm	1.2	0.92	10.73	0.2
Hg ppm	0.098	0.018	0.371	0.251
V ppm	-----	-----	----	----

NOTE: Above data based on 7 composite samples composed of a total of several thousand birch leaves.

VEGETATION: Birch (leaves) (f)
TAILINGS TYPE: Uranium (Non-Acid) (A)
(Acid) (B)

Parameter	Veg. Sample (106) (A)	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 1 (B)	Conc. in Tailings	Ratio Veg./Tail.
N ppm	18,000	50.1	359	30,000	75.4	398
P ppm	1,800	910	2	2,700	48	56
K ppm	13,300	17,700	0.8	16,100	28,000	0.6
Ca ppm	22,200	374	59	11,000	97.8	112
Mg ppm	5,700	7,190	0.8	1,800	783	2.3
Na ppm	200	26,500	0.01	300	1,170	0.3
S ppm	1,100	12,754	0.09	6,200	4,662	1.3
Se ppm	0.05	-1	=0.05	0.03	-1	=0.03
B ppm	380	84	4.5	56	107	0.5
As ppm	0.44	621	0.00	0.17	137	0.00
Ni ppm	7.14	64	0.11	4.64	-10	=0.46
Pb ppm	11.25	115	0.10	4.38	23	0.19
Cd ppm	0.42	1.0	0.42	-0.08	0.3	-0.27
Cr ppm	0.88	89	0.01	1.18	20	0.06
Fe ppm	65	57,100	0.00	120	11,100	0.01
Mn ppm	885	985	0.9	45	-10	=4.5
Cu ppm	7.0	39	0.2	13.2	39	0.3
Zn ppm	306	148	2.1	125	9.8	12.8
Al ppm	46	25,800	0.00	53	19,600	0.00
Mo ppm	1.39	1.1	1.3	0.50	2.7	0.2
Co ppm	2.67	17	0.16	4.60	-1	=4.6
Hg ppm	0.076	0.053	1.434	0.055	0.06	0.9
V ppm	---	158	----	----	40	---

VEGETATION: Birch (leaves) (g)
TAILINGS TYPE: Sulphide (Acid) (Cu, Ni)

Parameter	Veg. Sample 17	Conc. in Tailings	Ratio Veg./Tail.
N ppm	22,500	-2.8	=8036
P ppm	1,100	330	3.3
K ppm	9,100	4,690	1.9
Ca ppm	12,400	3,710	3.3
Mg ppm	2,900	11,400	0.3
Na ppm	200	10,200	0.02
S ppm	3,300	54,945	0.06
Se ppm	0.13	10	0.01
B ppm	60	96	0.6
As ppm	0.46	88	0.01
Ni ppm	30.35	4,570	0.01
Pb ppm	1.88	9	0.21
Cd ppm	0.42	4.4	0.1
Cr ppm	1.76	156	0.01
Fe ppm	180	375,000	0.00
Mn ppm	1,229	547	2.2
Cu ppm	13	381	0.03
Zn ppm	83	146	0.6
Al ppm	68	23,000	0.00
Mo ppm	0.28	1.1	0.3
Co ppm	2.67	143	0.02
Hg ppm	0.062	0.018	3.4
V ppm	-----	717	-----

VEGETATION: Birch Leaves (h)
BACKGROUND SAMPLES SUMMARY
Paleozoic Bedrock: Southern Ontario

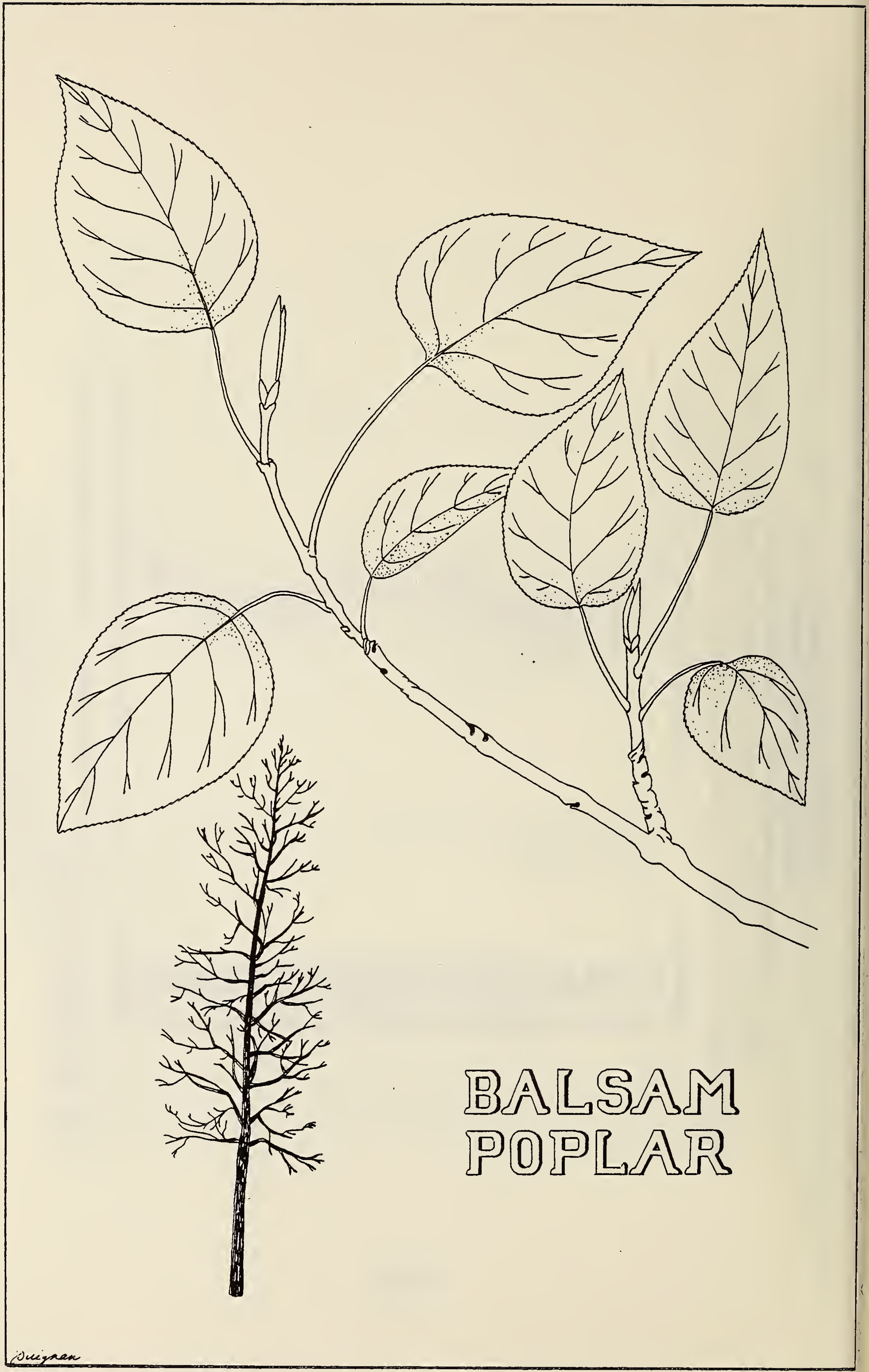
PARAMETER	AVERAGE CONCENTRATION (All Samples)
N ppm	24,000
P ppm	2,900
K ppm	8,100
Ca ppm	15,300
Mg ppm	4,500
Na ppm	400
S ppm	1,300
Se ppm	0.09
B ppm	52
As ppm	0.08
Ni ppm	0.71
Pb ppm	13.13
Cd ppm	0.25
Cr ppm	0.88
Fe ppm	80
Mn ppm	110
Cu ppm	7.4
Zn ppm	62
Al ppm	67
Mo ppm	0.85
Co ppm	0.73
Hg ppm	0.084

Note: Data based on two composite samples. Locations separated by approx. 100 kilometers. Samples represent a total of less than 3,000 individual leaves.

VEGETATION: Birch Leaves (i)
BACKGROUND SAMPLES SUMMARY
Precambrian Bedrock: Southern Ontario

PARAMETER	AVERAGE CONCENTRATION (All Samples)
N ppm	23,000
P ppm	1,800
K ppm	15,500
Ca ppm	15,000
Mg ppm	4,200
Na ppm	300
S ppm	800
Se ppm	0.03
B ppm	205
As ppm	0.24
Ni ppm	2.86
Pb ppm	8.13
Cd ppm	0.83
Cr ppm	1.18
Fe ppm	200
Mn ppm	870
Cu ppm	7.1
Zn ppm	403
Al ppm	126
Mo ppm	0.08
Co ppm	1.33
Hg ppm	0.080

Note: Data based on one composite sample only. Sample represents less than 1000 individual leaves.



BALSAM POPLAR

VEGETATION: Poplar Leaves (a)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 39	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 47	Conc. in Tailings	Ratio Veg./Tail.
N ppm	21,500	64.1	335	22,000	27.8	791
P ppm	1,000	473	2.1	800	261	3.1
K ppm	7,600	14,500	0.5	7,100	1,170	6.6
Ca ppm	10,100	4,100	2.5	9,600	486	19.8
Mg ppm	8,000	8,390	0.95	6,200	2,330	2.7
Na ppm	200	4,880	0.04	100	875	0.1
S ppm	1,500	21,711	0.07	100	8,991	0.01
Se ppm	0.03	-1	=0.03	0.32	5	0.06
B ppm	13	84	0.15	47	82	0.6
As ppm	0.20	820	0.00	0.92	1,310	0.00
Ni ppm	2.86	-10	=0.3	17.85	-10	=1.8
Pb ppm	4.38	70	0.06	5.00	3,160	0.00
Cd ppm	0.42	8.0	0.05	0.83	18.3	0.1
Cr ppm	0.73	78	0.01	1.03	39	0.03
Fe ppm	100	58,300	0.00	320	348,000	0.00
Mn ppm	153	1,350	0.11	117	97	1.2
Cu ppm	8.50	98	0.09	8.70	1,860	0.00
Zn ppm	543	351	1.5	351	4,070	0.09
Al ppm	39	20,200	0.00	105	4,090	0.03
Mo ppm	0.18	-0.6	=0.3	0.69	-0.6	=1.2
Co ppm	7.33	30	0.2	7.50	74	0.10
Hg ppm	0.044	0.010	4.4	0.073	0.017	4.294
V ppm	---	140	---	---	28	---

VEGETATION: Poplar Leaves
TAILINGS TYPE: Gold (Non-Acid)

(b)

Parameter	Veg. Sample 48	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 52	Conc. in Tailings	Ratio Veg./Tail.
N ppm	19,500	72.6	269	25,000	Not	
P ppm	900	239	3.8	1,900	Available	
K ppm	10,300	19,300	0.5	9,900		
Ca ppm	10,100	6,280	1.6	9,700		
Mg ppm	5,700	11,500	0.5	3,900		
Na ppm	300	4,490	0.07	300		
S ppm	200	8,392	0.02	1,900		
Se ppm	0.12	2	0.06	0.06		
B ppm	47	92	0.5	18		
As ppm	0.52	90	0.01	0.06		
Ni ppm	3.57	-10	=0.4	3.57		
Pb ppm	3.13	15	0.21	4.06		
Cd ppm	0.33	0.3	1.1	- 1.17		
Cr ppm	0.88	219	0.00	1.47		
Fe ppm	100	63,400	0.00	70		
Mn ppm	135	907	0.1	30		
Cu ppm	8.90	120	0.07	9.20		
Zn ppm	495	229	2.2	223		
Al ppm	62	29,100	0.00	45		
Mo ppm	0.22	0.6	0.4	1.34		
Co ppm	6.17	25	0.25	0.83		
Hg ppm	0.055	0.153	0.359	0.070		
V ppm	---	399	---	---		

VEGETATION: Poplar Leaves (c)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 54	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 57	Conc. in Tailings	Ratio Veg./Tail.
N ppm	25,00	Not		23,500	313	75.1
P ppm	1,700	Available		3,000	238	12.6
K ppm	13,900			15,400	9,210	1.7
Ca ppm	12,600			14,000	99	141
Mg ppm	5,800			6,800	1,190	5.7
Na ppm	300			200	1,490	0.1
S ppm	1,500			5,300	33,966	0.2
Se ppm	0.05			0.11	12	0.01
B ppm	43			90	77	1.2
As ppm	4.40			0.04	386	0.00
Ni ppm	10.71			2.86	386	0.01
Pb ppm	3.44			3.43	646	0.01
Cd ppm	1.66			0.50	51	0.01
Cr ppm	2.94			1.78	109	0.02
Fe ppm	540			125	370,000	0.00
Mn ppm	129			209	-10	=21
Cu ppm	10.4			6.20	1,820	0.00
Zn ppm	399			479	99	4.8
Al ppm	206			32	11,100	0.00
Mo ppm	0.44			1.11	55	0.02
Co ppm	6.92			7.50	463	0.02
Hg ppm	0.047			0.309	9.46	0.03
V ppm	---			---	119	---

VEGETATION: Poplar Leaves (d)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 59	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 63	Conc. in Tailings	Ratio Veg./Tail.
N ppm	21,500	55.7	386	17,500	100	175
P ppm	900	815	1.1	900	1,200	0.8
K ppm	11,100	34,700	0.3	9,100	8,590	1.1
Ca ppm	10,300	2,700	3.8	11,600	2,730	4.2
Mg ppm	6,400	4,920	1.3	5,600	4,100	1.4
Na ppm	300	23,000	0.01	300	24,400	0.01
S ppm	6,100	105,894	0.06	3,300	18,881	0.2
Se ppm	0.03	10	0.00	0.05	.3	0.02
B ppm	90	76	1.2	17	53	0.3
As ppm	0.20	116	0.00	8.00	5,530	0.00
Ni ppm	5.71	25	0.23	5.00	101	0.05
Pb ppm	2.81	26	0.11	5.31	-1	=5.3
Cd ppm	0.25	0.6	0.4	2.50	0.6	4.2
Cr ppm	0.74	87	0.01	0.74	59	0.01
Fe ppm	30	34,200	0.00	100	48,700	0.00
Mn ppm	78	338	0.2	40	937	0.04
Cu ppm	6.70	106	0.06	6.30	29	0.2
Zn ppm	847	77.1	11	559	68.3	8.2
Al ppm	30	45,200	0.00	38	30,000	0.00
Mo ppm	6.30	7.5	0.8	0.38	-0.6	=0.6
Co ppm	1.83	27	0.07	3.50	47	0.07
Hg ppm	0.091	2.27	0.040	0.047	0.171	0.275
V ppm	----	138	----	----	312	----

VEGETATION: Poplar Leaves (e)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 68	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 82	Conc. in Tailings	Ratio Veg./Tail.
N ppm	21,500	83.4	258	11,000	47.5	232
P ppm	2,400	514	4.7	400	716	0.6
K ppm	8,600	5,950	1.4	6,600	40,700	0.2
Ca ppm	10,700	4,890	2.2	13,600	1,690	8.0
Mg ppm	14,600	11,100	1.3	8,300	3,310	2.5
Na ppm	400	16,300	0.02	300	19,100	0.02
S ppm	5,200	18,248	0.3	3,700	10,223	0.4
Se ppm	0.06	4	0.02	0.08	2	0.04
B ppm	69	92	0.8	67	42	1.6
As ppm	0.62	825	0.00	0.16	80	0.00
Ni ppm	4.28	399	0.01	4.28	90	0.05
Pb ppm	4.69	14	0.3	7.50	61	0.12
Cd ppm	0.42	0.9	0.5	0.42	0.3	1.4
Cr ppm	0.88	566	0.00	0.59	159	0.00
Fe ppm	40	66,500	0.00	50	31,500	0.00
Mn ppm	46	1,360	0.03	255	417	0.6
Cu ppm	6.50	173	0.04	7.00	50	0.14
Zn ppm	383	355	1.1	773	119	6.5
Al ppm	31	9,310	0.00	26	40,300	0.00
Mo ppm	0.29	3,416	0.00	7.50	4.4	1.7
Co ppm	7.29	37	0.20	4.67	16	0.3
Hg ppm	0.040	0.198	0.202	0.065	2.44	0.027
V ppm	----	269	----	----	199	---

VEGETATION: Poplar Leaves (f)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 85	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 87	Conc. in Tailings	Ratio Veg./Tail.
N ppm	10,500	61.2	172	20,500	92.3	222
P ppm	400	776	0.5	1,100	673	1.6
K ppm	7,500	35,000	0.2	9,600	38,800	0.2
Ca ppm	11,000	2,630	4.2	12,800	2,780	4.6
Mg ppm	5,600	5,160	1.1	7,100	5,940	1.2
Na ppm	300	22,000	0.01	400	18,400	0.02
S ppm	2,600	11,355	0.23	5,700	8,392	0.7
Se ppm	0.08	-1	=0.08	0.04	-1	=0.04
B ppm	48	102	0.5	73	79	0.9
As ppm	0.15	117	0.00	0.42	115	0.00
Ni ppm	10.00	-10	=1	28.56	75	0.4
Pb ppm	4.38	11	0.40	4.38	18	0.24
Cd ppm	0.33	0.6	0.6	0.33	0.6	0.7
Cr ppm	0.88	107	0.01	1.76	182	0.01
Fe ppm	40	33,400	0.00	550	31,300	0.02
Mn ppm	105	379	0.3	333	460	0.7
Cu ppm	8.10	78	0.10	9.70	38	0.26
Zn ppm	708	87.5	8.1	886	105	8.4
Al ppm	24	41,700	0.00	98	39,100	0.00
Mo ppm	3.70	4.3	0.9	31.20	3.6	8.7
Co ppm	2.25	14	0.16	7.08	13	0.54
Hg ppm	0.047	0.201	0.234	0.055	1.24	0.044
V ppm	---	195	---	---	137	---

VEGETATION: Poplar Leaves (g)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 79	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 96	Conc. in Tailings	Ratio Veg./Tail.
N ppm	20,500	313	65	11,000	14	786
P ppm	1,600	238	6.7	700	1,560	0.4
K ppm	9,100	9,210	0.99	19,500	38,100	0.5
Ca ppm	11,100	99	112	18,000	3,430	5.2
Mg ppm	8,300	1,190	6.97	7,600	8,770	0.9
Na ppm	100	1,490	0.07	600	17,600	0.03
S ppm	2,700	33,966	0.08	9,800	6,960	1.4
Se ppm	0.23	12	0.02	0.05	4	0.01
B ppm	57	77	0.7	205	101	2.03
As ppm	0.14	386	0.00	0.24	562	0.00
Ni ppm	3.57	386	0.01	39.27	-10	=3.93
Pb ppm	3.13	646	0.00	2.50	9	0.28
Cd ppm	-0.08	51	-0.00	0.17	0.6	0.3
Cr ppm	0.88	109	0.01	1.03	124	0.01
Fe ppm	40	370,000	0.00	150	47,000	0.00
Mn ppm	195	-10	=19.5	332	648	0.5
Cu ppm	5.7	1,820	0.00	7.90	76	0.10
Zn ppm	352	99	3.6	725	200	3.6
Al ppm	35	11,100	0.00	55	33,800	0.00
Mo ppm	84.8	55	1.5	25.0	1.6	15.6
Co ppm	10.40	463	0.02	8.17	13	0.63
Hg ppm	0.055	9.46	0.01	0.036	3.76	0.01
V ppm	---	119	---	---	114	---

VEGETATION: Poplar Leaves (h)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 117	Conc. in Tailings	Ratio Veg./Tail.
N ppm	24,000	19.5	1,231
P ppm	1,700	157	10.8
K ppm	22,700	10,600	2.1
Ca ppm	21,000	2,440	8.6
Mg ppm	1,500	5,270	0.3
Na ppm	100	13,800	0.01
S ppm	2,200	4,496	0.49
Se ppm	0.05	-1	=0.05
B ppm	38	100	0.38
As ppm	0.11	59	0.00
Ni ppm	6.78	-10	=0.7
Pb ppm	4.38	17	0.26
Cd ppm	2.17	0.3	7.2
Cr ppm	1.18	68	0.02
Fe ppm	50	15,500	0.00
Mn ppm	390	107	3.6
Cu ppm	9.20	39	0.24
Zn ppm	885	48.8	18.1
Al ppm	28	28,600	0.00
Mo ppm	0.72	2.1	0.3
Co ppm	3.58	20	0.18
Hg ppm	0.033	0.020	1.650
V ppm	---	78	---

(i)

VEGETATION: Poplar Leaves
TAILINGS TYPE: Gold (Non-Acid)
SUMMARY: VEGETATION ANALYTICAL DATA

PARAMETER	AVERAGE CONCENTRATION All Samples	RANGE All Samples Low	RANGE All Samples High	AVERAGE RATIO VEG/TAIL. All Samples
N ppm	19,633	10,500	25,000	384
P ppm	1,293	400	3,000	3.8
K ppm	11,200	6,600	22,700	0.8
Ca ppm	12,413	9,600	21,000	5.9
Mg ppm	6,760	1,500	14,600	1.3
Na ppm	340	100	600	0.04
S ppm	3,453	100	9,800	0.3
Se ppm	0.09	0.03	0.32	=0.03
B ppm	51.2	13	205	0.7
As ppm	0.3	0.04	8.00	0.00
Ni ppm	5.3	2.86	39.27	=0.4
Pb ppm	4.2	2.50	7.50	0.2
Cd ppm	0.6	0.08	2.50	0.5
Cr ppm	1.2	0.59	2.94	0.01
Fe ppm	93	30	550	0.00
Mn ppm	170	30	390	0.4
Cu ppm	7.9	5.7	10.4	0.10
Zn ppm	574	223	886	5.4
Al ppm	46	24	206	0.00
Mo ppm	data variable*	0.18	84.8	=0.70
Co ppm	6	0.83	10.04	0.21
Hg ppm	0.054	0.033	0.309	0.3**

Note: Above data based on 15 composite samples composed of a total of approx. 7,500 individual leaves from a large number of trees.

* Routine conc. 0.6. However, in some cases, avg. concentration exceeded 25

** In two cases, exceeded 4

VEGETATION: Poplar Leaves (j)
TAILINGS TYPE: Acid Sulphide (Cu, Pb, Zn, Ni)

Parameter	Veg. Sample 113	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 27	Conc. in Tailings	Ratio Veg./Tail.
N ppm	28,500	47.4	601	22,800	55.6	410
P ppm	2,300	330	7	2,100	666	3.2
K ppm	21,100	16,700	1.3	27,300	9,560	2.9
Ca ppm	23,400	2,370	9.9	18,400	3,780	4.9
Mg ppm	2,500	5,730	0.4	2,900	7,970	0.4
Na ppm	500	18,700	0.03	600	7,570	0.08
S ppm	---	13,410	---	5,600	19,214	0.3
Se ppm	22.0	68	0.3	0.55	15	0.04
B ppm	27.0	100	0.3	47	81	0.6
As ppm	0.07	1,010	0.00	6.3	269	0.02
Ni ppm	4.64	90	0.05	78.54	1,680	0.05
Pb ppm	3.75	1,293	0.00	9.38	23	0.41
Cd ppm	20.0	14.4	1.4	3.17	1.9	1.7
Cr ppm	1.03	89	0.01	2.06	269	0.01
Fe ppm	190	136,000	0.00	730	105,000	0.01
Mn ppm	525	188	2.8	171	876	0.2
Cu ppm	13.9	945	0.01	33.3	608	0.05
Zn ppm	1,417	1,660	0.9	104	110	0.9
Al ppm	110	36,500	0.00	128	28,200	0.00
Mo ppm	0.53	2.8	0.2	2.06	-0.6	=3.4
Co ppm	3.83	160	0.02	11.46	64	0.2
Hg ppm	0.029	0.283	0.102	0.142	0.088	1.614
V ppm	---	40	---	---	199	---

VEGETATION: Poplar Leaves (k)
TAILINGS TYPE: Silver (Non-Acid)

Parameter	Veg. Sample 71	Conc. in Tailings	Ratio Veg./Tail.
N ppm	22,000	42	524
P ppm	1,200	524	2.3
K ppm	12,600	10,625	1.2
Ca ppm	17,700	4,965	3.6
Mg ppm	1,400	10,225	0.1
Na ppm	200	8,050	0.02
S ppm	900	5,345	0.2
Se ppm	0.02	2	0.01
B ppm	54	81	0.7
As ppm	10.00	7,665	0.00
Ni ppm	3.21	190	0.02
Pb ppm	1.88	27	0.07
Cd ppm	0.58	1.2	0.5
Cr ppm	0.59	238	0.00
Fe ppm	80	57,550	0.00
Mn ppm	38	1,054	0.04
Cu ppm	6.0	112	0.05
Zn ppm	143	107	1.3
Al ppm	57	19,900	0.00
Mo ppm	7.5	1.4	5.4
Co ppm	1,770	363	4.9
Hg ppm	0.073	0.972	0.075
V ppm	---	181	---

VEGETATION: Poplar Leaves (1)
TAILINGS TYPE: Uranium (Acid)

Parameter	Veg. Sample 6N	Conc. in Tailings	Ratio Veg./Tail.
N ppm	16,760	30	559
P ppm	1,590	66	24
K ppm	13,500	6,400	2.1
Ca ppm	24,000	1,900	12.6
Mg ppm	2,700	140	19
Na ppm	-4	12,300	0.00
S ppm	4,400	6,900	0.6
Se ppm	-1	-0.5	=2 ?
B ppm	---	-20	---
As ppm	-1	-5	=.2 ?
Ni ppm	-3	-2	=1.5 ?
Pb ppm	15	150	0.1
Cd ppm	-1	-2	=0.5 ?
Cr ppm	-5	14	-0.4
Fe ppm	180	4,300	0.04
Mn ppm	5	5	1
Cu ppm	12	17	0.7
Zn ppm	189	6	31.5
Al ppm	---	17,300	---
Mo ppm	---	65	---
Co ppm	-2	7	-0.3
Hg ppm	---	0.13	---
V ppm	-6	-10	=0.6 ?

VEGETATION: Poplar Leaves (m)
TAILINGS TYPE: Uranium (Non-Acid)

Parameter	Veg. Sample 7N	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 8N	Conc. in Tailings	Ratio Veg./Tail.
N ppm	6,930	50.1	138	8,560	15	571
P ppm	1,120	910	1.2	1,690	265	6.4
K ppm	6,000	17,700	0.3	5,800	16,900	0.3
Ca ppm	23,500	374	62.8	23,500	26,010	0.9
Mg ppm	2,000	7,190	0.3	3,500	1,690	2.1
Na ppm	-4	26,500	-0.00	11	19,300	0.00
S ppm	1,900	12,754	0.1	6,700	18,100	0.4
Se ppm	-1	-1	=1 ?	-1	-0.5	=2 ?
B ppm	---	84	---	---	-20	---
As ppm	3	621	0.00	-1	15	-0.1
Ni ppm	-3	64	-0.05	-3	24	-0.1
Pb ppm	20	115	0.2	15	180	0.08
Cd ppm	-1	1.0	-1.0	-1	-2	=0.5 ?
Cr ppm	-5	89	-0.06	-5	21	-0.2
Fe ppm	50	57,100	0.00	160	30,200	0.01
Mn ppm	100	985	0.1	400	845	0.5
Cu ppm	6	39	0.2	12	50	0.2
Zn ppm	274	148	1.9	192	222	0.9
Al ppm	---	25,800	---	---	50,200	---
Mo ppm	---	1.1	---	---	35	---
Co ppm	-2	17	-0.1	-2	23	-0.09
Hg ppm	---	0.053	---	---	0.09	---
V ppm	-6	158	-0.04	-6	40	-0.2

VEGETATION: Poplar Leaves (n)
BACKGROUND SAMPLES SUMMARY
Paleozoic Bedrock: Southern Ontario

PARAMETER	AVERAGE CONCENTRATION (All Samples)
N ppm	21,800
P ppm	1,600
K ppm	6,900
Ca ppm	20,100
Mg ppm	4,200
Na ppm	400
S ppm	2,300
Se ppm	0.07
B ppm	58
As ppm	0.08
Ni ppm	0.86
Pb ppm	5.16
Cd ppm	0.79
Cr ppm	0.78
Fe ppm	53
Mn ppm	69
Cu ppm	8.4
Zn ppm	153
Al ppm	54
Mo ppm	0.20
Co ppm	0.71
Hg ppm	0.089

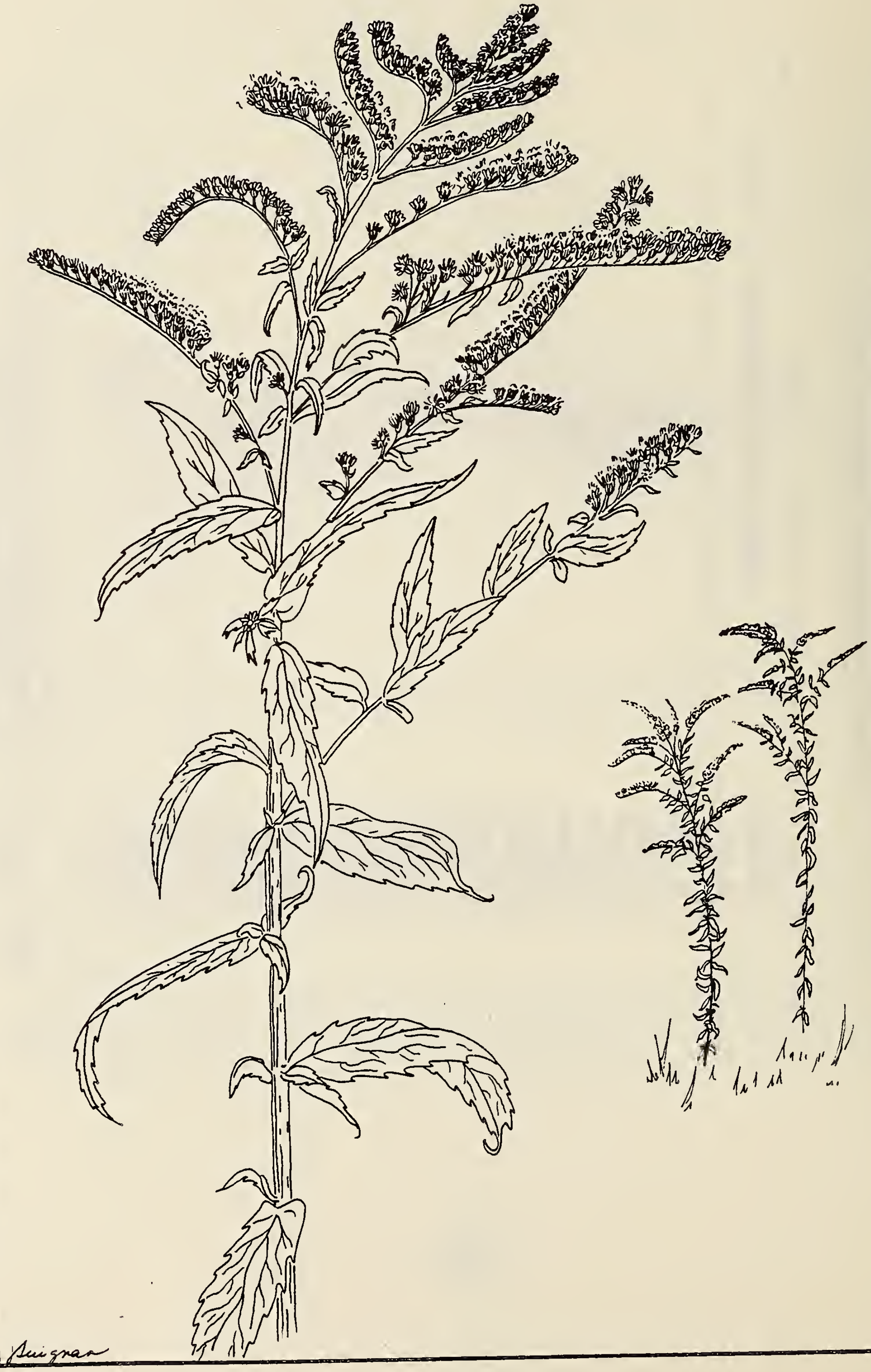
Note: Above data based on 2 composite samples composed of a total of approx. 1,000 individual leaves from a number of trees.

VEGETATION: Poplar Leaves (o)
BACKGROUND SAMPLES SUMMARY
Precambrian Bedrock: Southern Ontario

PARAMETER	AVERAGE CONCENTRATION (All Samples)
N ppm	24,000
P ppm	1,800
K ppm	7,100
Ca ppm	28,000
Mg ppm	4,500
Na ppm	1,500
S ppm	1,600
Se ppm	0.02
B ppm	50
As ppm	0.20
Ni ppm	1.79
Pb ppm	4.38
Cd ppm	1.83
Cr ppm	1.17
Fe ppm	80
Mn ppm	177
Cu ppm	8.4
Zn ppm	612
Al ppm	52
Mo ppm	0.08
Co ppm	1.83
Hg ppm	0.073

Note: Above based on 1 composite sample only composed of approximately 500 individual leaves from a number of trees.

CANADA GOLDENROD



VEGETATION: Canada Goldenrod (flower, leaves and stems) (a)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 41N	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 17N	Conc. in Tailings	Ratio Veg./Tail.
N ppm	11,050	92.3	120	5,530	55.7	99
P ppm	1,860	673	2.8	1,420	815	1.7
K ppm	18,900	38,800	0.5	16,400	34,700	0.5
Ca ppm	20,500	2,780	7.4	16,600	2,700	6
Mg ppm	4,200	5,940	0.7	5,400	4,920	1.1
Na ppm	-4	18,400	-0.00	-4	23,000	0.00
S ppm	4,100	8,392	0.5	3,800	105,894	0.04
Se ppm	-1	-1	-1	-1	10	-0.1
B ppm	---	79	---	---	76	---
As ppm	2	115	0.02	5	116	0.04
Ni ppm	-3	75	-0.04	-3	25	-0.12
Pb ppm	6	18	0.3	2	26	0.08
Cd ppm	-1	0.6	-1.7	-1	0.6	-1.7
Cr ppm	-5	182	-0.03	-5	87	-0.06
Fe ppm	480	31,300	0.02	70	34,200	0.00
Mn ppm	-50	460	-0.1	-50	338	-0.15
Cu ppm	15	38	0.4	8	106	0.08
Zn ppm	44	105	0.4	52	77.1	0.7
Al ppm	---	39,100	---	---	45,200	---
Mo ppm	---	3.6	---	---	7.5	---
Co ppm	-2	13	-0.2	-2	27	-0.07
Hg ppm	---	1.24	---	---	2.27	---
V ppm	-6	137	-0.04	-6	138	-0.04

VEGETATION: Canada Goldenrod (flowers, leaves and stems) (b)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 10N	Conc. in Tailings	Ratio Veg./Tail.
N ppm	12,680	47.5	267
P ppm	1,960	716	2.7
K ppm	14,400	40,700	0.4
Ca ppm	15,600	1,690	9.2
Mg ppm	2,300	3,310	0.7
Na ppm	78	19,100	0.00
S ppm	-100	10,223	-0.01
Se ppm	-1	2	-0.5
B ppm	---	42	---
As ppm	4	80	0.05
Ni ppm	-3	90	-0.03
Pb ppm	8	61	0.13
Cd ppm	-1	0.3	-3.3
Cr ppm	-5	159	-0.03
Fe ppm	80	31,500	0.00
Mn ppm	1,400	417	3.4
Cu ppm	8	50	0.2
Zn ppm	46	119	0.4
Al ppm	---	40,300	---
Mo ppm	---	4.4	---
Co ppm	-2	16	-0.1
Hg ppm	---	2.44	---
V ppm	-6	199	-0.03

VEGETATION: Canada Goldenrod (flowers, stems, leaves) (c)
TAILINGS TYPE: Gold (Non-Acid)
SUMMARY: VEGETATION ANALYTICAL DATA

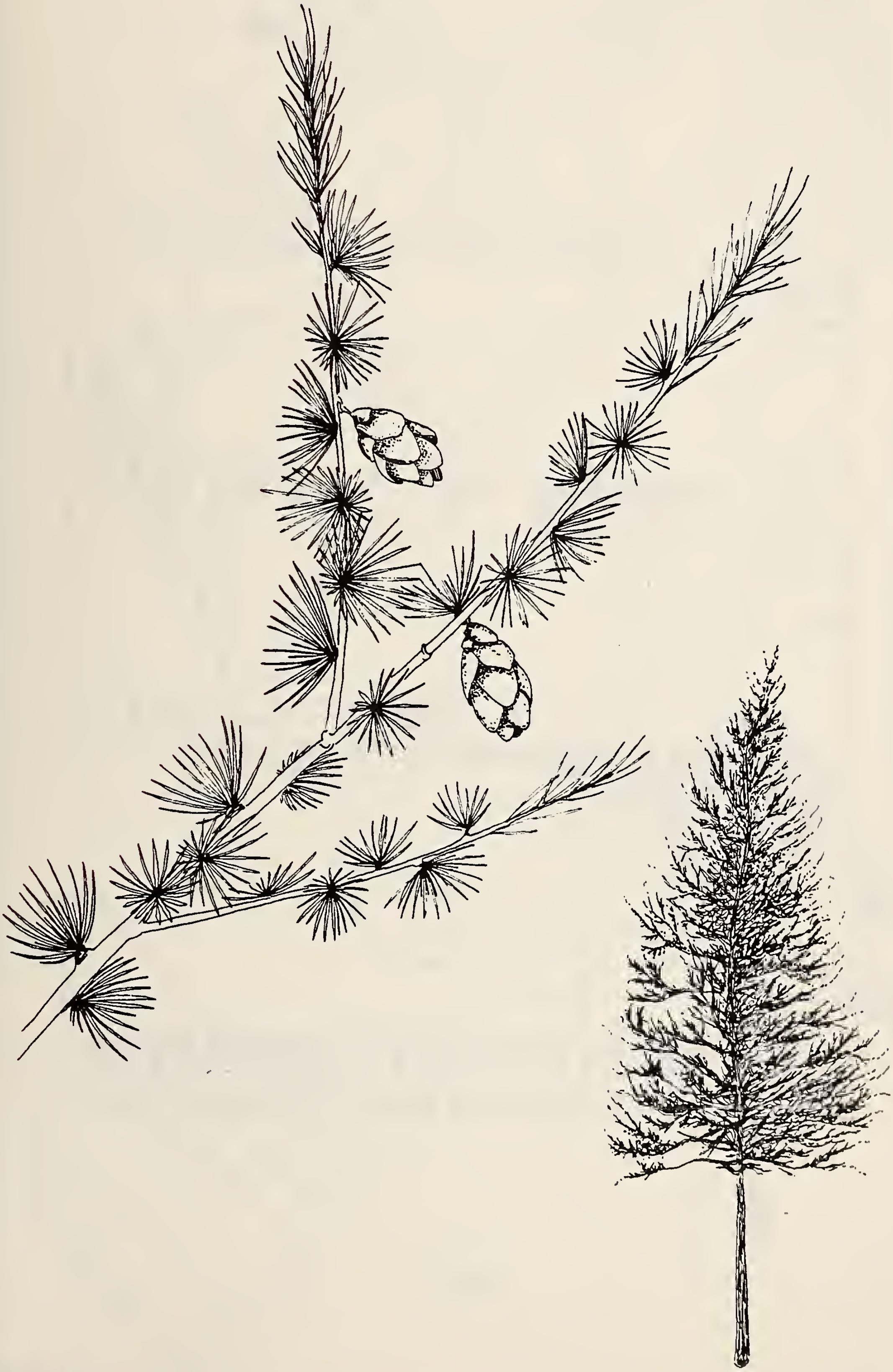
PARAMETER	AVERAGE CONCENTRATION All Samples	RANGE All Samples Low	High	AVERAGE RATIO VEG/TAIL. All Samples
N ppm	9,753	5,530	12,680	162
P ppm	1,747	1,420	1,960	2.4
K ppm	16,568	14,400	18,900	0.5
Ca ppm	17,567	15,600	20,500	7.5
Mg ppm	3,967	2,300	5,400	0.8
Na ppm	data variable	-4	78	-0.00
S ppm	data variable	-100	4,100	-0.2
Se ppm	-1	-1	-1	-0.5
B ppm	---	---	---	---
As ppm	3.7	2	5	0.04
Ni ppm	-3	-3	-3	-0.06
Pb ppm	5.3	2	8	0.2
Cd ppm	-1	-1	-1	-2.2
Cr ppm	-5	-5	-5	-0.04
Fe ppm	210	70	480	0.01
Mn ppm	data variable	-50	1,400	---
Cu ppm	10.3	8	15	0.2
Zn ppm	47.3	44	52	0.5
Al ppm	---	---	---	---
Mo ppm	---	---	---	---
Co ppm	-2	-2	-2	-0.1
Hg ppm	---	---	---	---
V ppm	-6	-6	-6	-0.04

Note: Data based on 3 composite samples representing less than 50 individual plants.

VEGETATION: Canada Goldenrod (flowers, leaves and stems) (d)
TAILINGS TYPE: Uranium (Non-Acid)

Parameter	Veg. Sample 27N	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 46N	Conc. in Tailings	Ratio Veg./Tail.
N ppm	9,200	50.1	184	4,860	25	194
P ppm	1,240	910	1.4	1,170	353	3.3
K ppm	14,100	17,700	0.8	16,500	21,900	0.8
Ca ppm	20,000	374	53	16,700	12,010	1.4
Mg ppm	4,900	7,190	0.7	2,000	1,150	1.7
Na ppm	-4	26,500	-0.00	76	17,800	0.00
S ppm	3,200	12,754	0.3	4,600	5,500	0.8
Se ppm	-1	-1	-1	-1	-0.5	-2
B ppm	---	84	---	---	-20	---
As ppm	-1	621	-0.00	5	15	0.3
Ni ppm	-3	64	-0.05	-3	2	-1.5
Pb ppm	10	115	0.09	12	65	0.2
Cd ppm	-1	1.0	-1	2	-2	=1
Cr ppm	-5	89	-0.07	-5	12	-0.4
Fe ppm	230	57,100	0.00	120	16,700	0.01
Mn ppm	200	985	0.2	850	305	2.8
Cu ppm	12	39	0.3	10	18	0.6
Zn ppm	120	148	0.8	115	49	2.3
Al ppm	---	25,800	---	---	49,800	---
Mo ppm	---	1.1	---	---	35	---
Co ppm	-2	17	-0.1	-2	9	0.2
Hg ppm	---	0.053	---	---	0.01	---
V ppm	-6	158	-0.04	-6	25	-0.2

TAMARACK

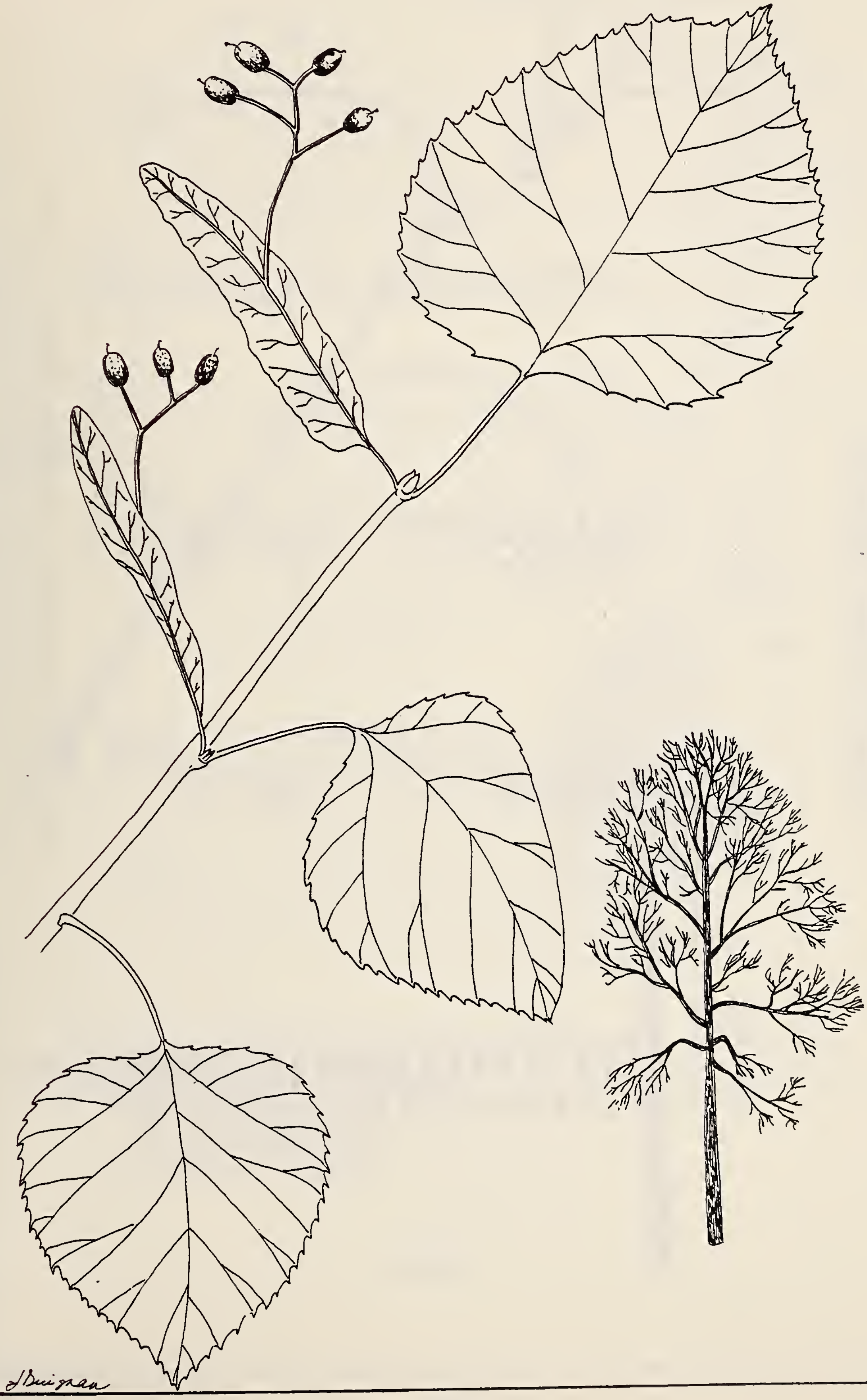


Guignau

VEGETATION: Tamarack (Larch) (needles) (a)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 61	Conc. in Tailings	Ratio Veg./Tail.
N ppm	20,500	100	205
P ppm	1,200	1,200	1
K ppm	9,300	8,590	1.1
Ca ppm	4,000	2,730	1.5
Mg ppm	3,200	4,100	0.8
Na ppm	200	24,400	0.01
S ppm	4,700	18,881	0.2
Se ppm	0.28	3	0.09
B ppm	35	53	0.7
As ppm	16.0	5,530	0.00
Ni ppm	1.79	101	0.02
Pb ppm	5.00	-1	=5
Cd ppm	0.17	0.6	0.3
Cr ppm	1.18	59	0.02
Fe ppm	220	48,700	0.00
Mn ppm	833	937	0.9
Cu ppm	6.5	29	0.2
Zn ppm	32	68.3	0.5
Al ppm	40	30,000	0.00
Mo ppm	0.62	-0.6	=1.0
Co ppm	0.58	47	0.01
Hg ppm	0.055	0.171	0.322
V ppm	---	312	---

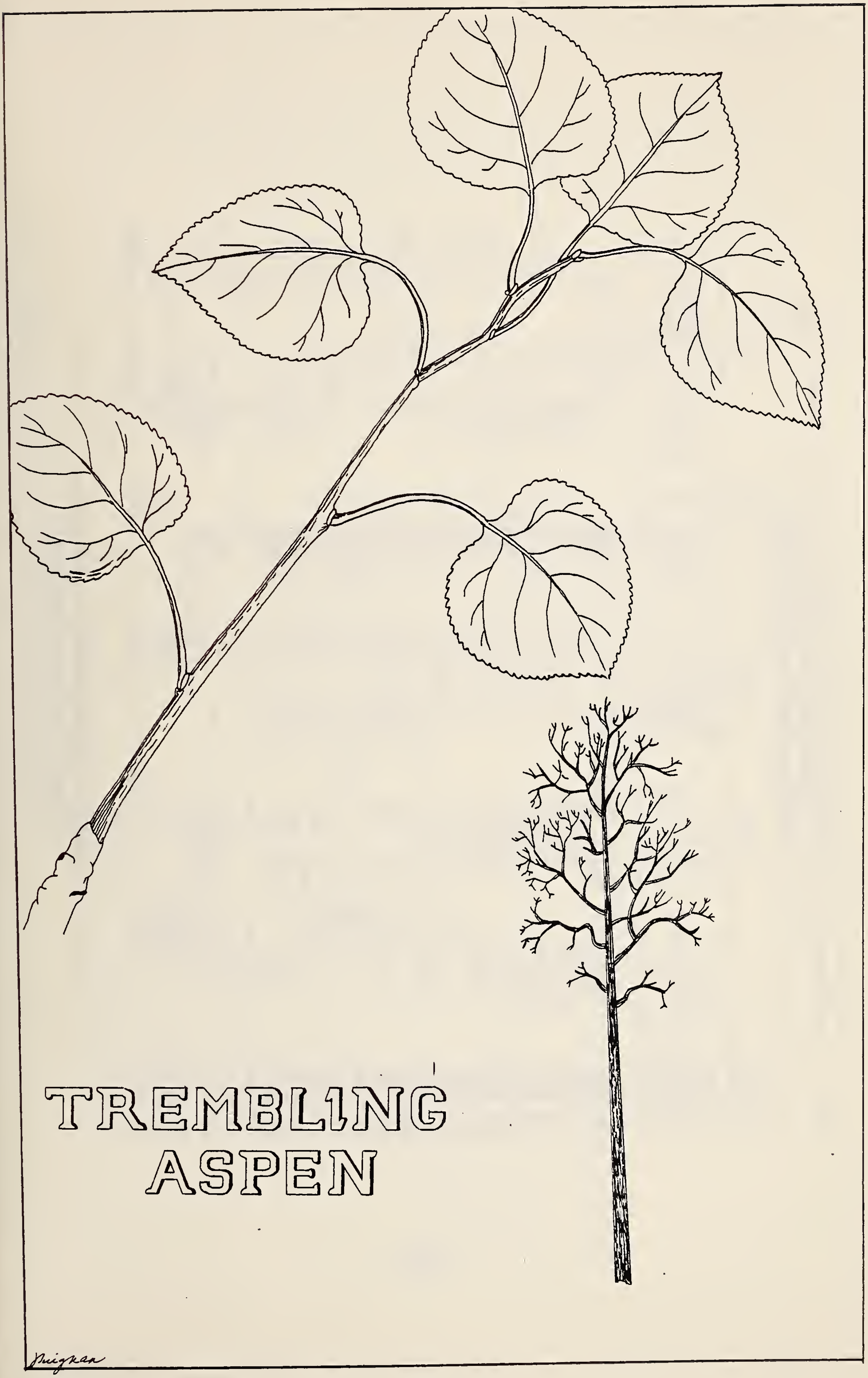
AMERICAN BASSWOOD



VEGETATION: Basswood (leaves) (a)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 92	Conc. in Tailings	Ratio Veg./Tail.
N ppm	19,500	22.3	874
P ppm	1,600	1,440	1.1
K ppm	13,500	42,400	0.3
Ca ppm	30,000	3,840	7.8
Mg ppm	6,800	8,970	0.8
Na ppm	300	14,000	0.02
S ppm	6,800	4,662	1.5
Se ppm	0.12	2	0.06
B ppm	52	100	0.5
As ppm	0.18	39	0.00
Ni ppm	21.78	-10	=2.3
Pb ppm	6.25	9	0.7
Cd ppm	0.58	0.6	1.0
Cr ppm	1.47	157	0.01
Fe ppm	420	49,200	0.01
Mn ppm	288	611	0.5
Cu ppm	9.5	99	0.1
Zn ppm	765	108	7.1
Al ppm	92	29,500	0.00
Mo ppm	60.0	5.5	10.9
Co ppm	3.67	35	0.1
Hg ppm	-0.025	0.318	-0.079
V ppm	---	158	---

TREMBLING ASPEN



VEGETATION: Aspen (leaves) (a)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 89	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 90	Conc. in Tailings	Ratio Veg./Tail.
N ppm	24,000	92.3	260	18,000	22.3	807
P ppm	1,500	673	2.2	900	1,440	0.6
K ppm	14,200	38,800	0.4	19,300	42,400	0.5
Ca ppm	14,500	2,780	5.2	16,800	3,840	4.5
Mg ppm	8,900	5,940	1.5	9,400	8,970	1.0
Na ppm	300	18,400	0.02	400	14,000	0.03
S ppm	4,000	8,392	0.5	6,600	4,662	1.4
Se ppm	0.08	-1	=0.08	0.07	2	0.04
B ppm	220	79	2.8	51	100	0.5
As ppm	0.24	115	0.00	0.10	39	0.00
Ni ppm	23.21	75	0.3	8.21	-10	=0.8
Pb ppm	4.06	18	0.2	4.69	9	0.5
Cd ppm	0.83	0.6	1.4	0.50	0.6	0.8
Cr ppm	1.91	182	0.01	0.74	157	0.00
Fe ppm	100	31,300	0.00	100	49,200	0.00
Mn ppm	195	460	0.4	308	611	0.5
Cu ppm	11.8	38	0.3	8.0	99	0.1
Zn ppm	1,127	105	10.7	805	108	7.5
Al ppm	32	39,100	0.00	25	29,500	0.00
Mo ppm	10.00	3.6	2.8	31.30	5.5	5.6
Co ppm	6.25	13	0.5	7.16	35	0.2
Hg ppm	0.062	1.24	0.05	0.033	0.318	0.104
V ppm	---	137	---	---	158	---

VEGETATION: Aspen (leaves)
TAILINGS TYPE: Gold (Non-Acid)
SUMMARY: VEGETATION ANALYTICAL DATA

(b)

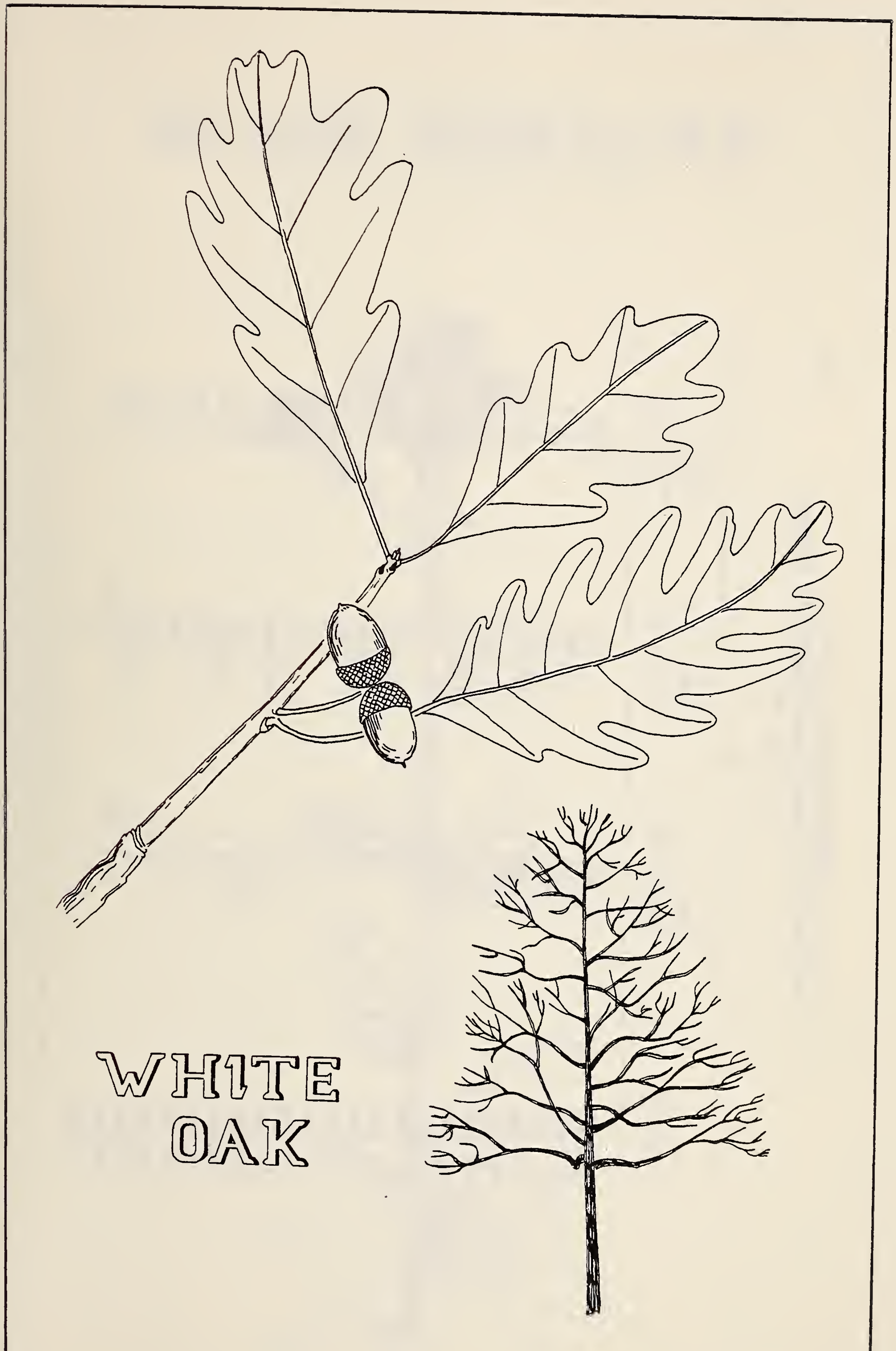
PARAMETER	AVERAGE CONCENTRATION All Samples	RANGE All Samples		AVERAGE RATIO VEG/TAIL. All Samples
		Low	High	
N ppm	21,000	18,000	24,000	534
P ppm	1,200	900	1,500	1.4
K ppm	16,750	14,200	19,300	0.5
Ca ppm	15,650	14,500	16,800	4.9
Mg ppm	9,150	8,900	9,400	1.3
Na ppm	350	300	400	0.03
S ppm	5,300	4,000	6,600	1.0
Se ppm	0.08	0.07	0.08	=0.06
B ppm	136	51	220	1.7
As ppm	0.17	0.10	0.24	0.00
Ni ppm	15.7	8.21	23.21	=0.6
Pb ppm	4.38	4.06	4.69	0.4
Cd ppm	0.67	0.50	0.83	1.1
Cr ppm	1.33	0.74	1.91	0.01
Fe ppm	100	100	100	0.00
Mn ppm	252	195	308	0.5
Cu ppm	9.9	8.0	11.8	0.2
Zn ppm	966	805	1,127	9.1
Al ppm	29	25	32	0.00
Mo ppm	20.65	10.00	31.30	4.2
Co ppm	6.71	6.25	7.16	0.4
Hg ppm	0.048	0.033	0.062	0.08

Note: Data based on two composite samples representing approximately 1000 individual leaves.

VEGETATION: Aspen (leaves) (c)
BACKGROUND SAMPLES SUMMARY
Paleozoic Bedrock: Southern Ontario

PARAMETER	AVERAGE CONCENTRATION (All Samples)
N ppm	24,000
P ppm	2,300
K ppm	9,000
Ca ppm	13,300
Mg ppm	5,100
Na ppm	200
S ppm	2,400
Se ppm	0.08
B ppm	48
As ppm	0.18
Ni ppm	0.71
Pb ppm	5.63
Cd ppm	0.83
Cr ppm	0.82
Fe ppm	70
Mn ppm	123
Cu ppm	9.3
Zn ppm	97
Al ppm	50
Mo ppm	1.20
Co ppm	0.75
Hg ppm	0.076

Note: Data based on a single composite sample composed of approximately 500 individual leaves.

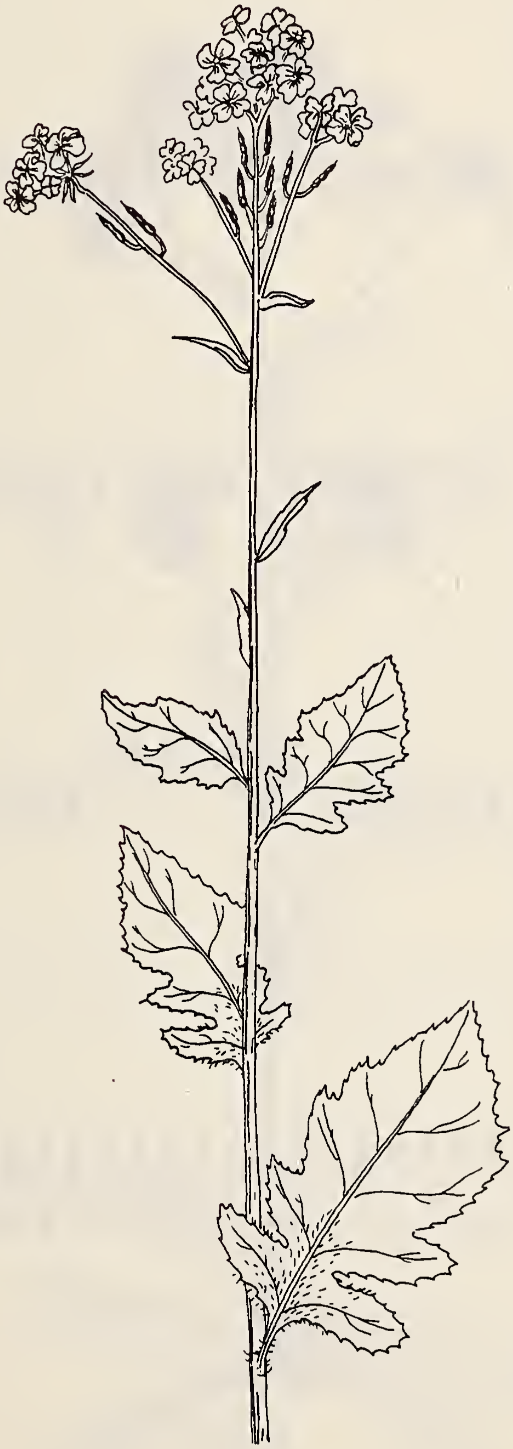


WHITE
OAK

VEGETATION: Oak (leaves) (a)
TAILINGS TYPE: Smelting and Refining Residue
(Co, Ag, As)

Parameter	Veg. Sample 126	Conc. in Tailings	Ratio Veg./Tail.
N ppm	22,500	20	1125
P ppm	2,100	1,095	1.9
K ppm	7,100	300	23.7
Ca ppm	11,000	37,000	0.3
Mg ppm	1,000	30	33.3
Na ppm	100	260	0.4
S ppm	1,500	113,500	0.01
Se ppm	0.05	-0.5	=0.1
B ppm	205	-20	=10.3
As ppm	10	34,000	0.00
Ni ppm	18.21	1,485	0.01
Pb ppm	1.25	68	0.02
Cd ppm	-0.08	-2	-0.04
Cr ppm	0.74	186	0.00
Fe ppm	60	80,000	0.00
Mn ppm	1,035	42	24.6
Cu ppm	6.2	6,880	0.00
Zn ppm	19	250	0.08
Al ppm	107	550	0.2
Mo ppm	0.21	445	0.00
Co ppm	1.83	2,650	0.00
Hg ppm	0.106	0.42	0.25
V ppm	---	-8	---

BLACK MUSTARD

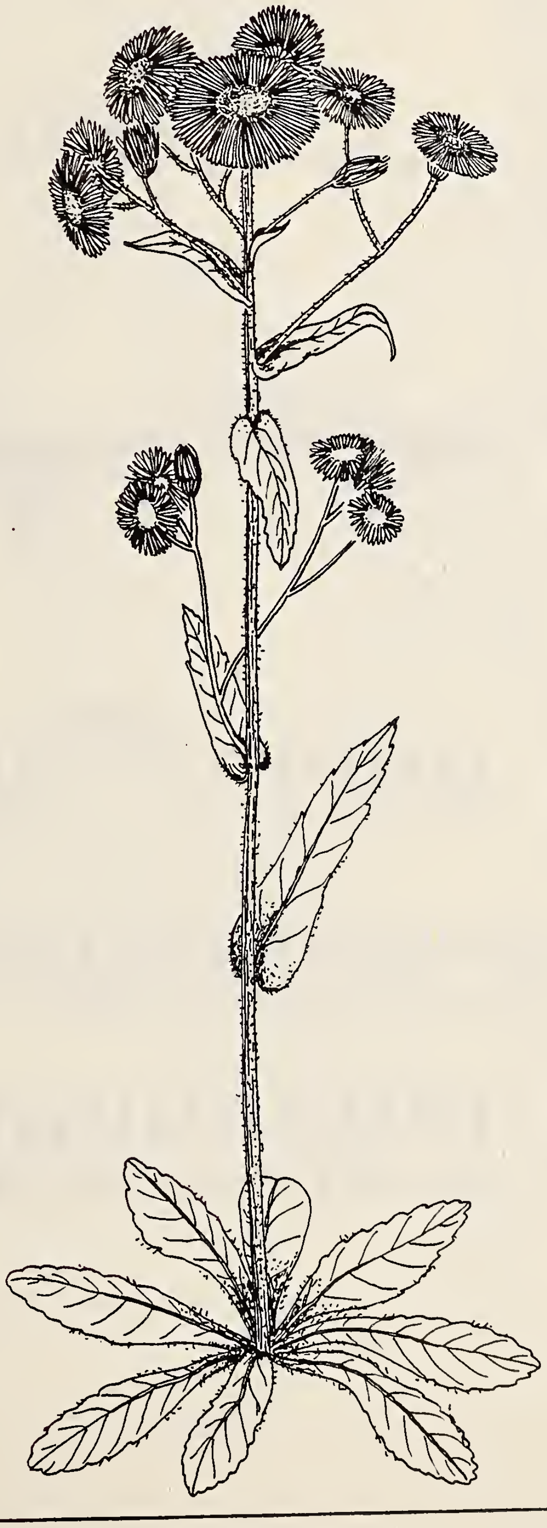


J. Duignan

VEGETATION: Yellow Mustard (leaves, flowers, stems) (a)
TAILINGS TYPE: Sulphide (Acid) (Cu, Ni)

Parameter	Veg. Sample 19	Conc. in Tailings	Ratio Veg./Tail.
N ppm	23,500	-2.8	=8393
P ppm	800	330	2.4
K ppm	14,700	4,690	3.1
Ca ppm	4,100	3,710	1.1
Mg ppm	1,800	11,400	0.2
Na ppm	300	10,200	0.03
S ppm	700	54,945	0.01
Se ppm	0.16	10	0.02
B ppm	26	96	0.3
As ppm	0.20	88	0.00
Ni ppm	7.85	4,570	0.00
Pb ppm	2.50	9	0.3
Cd ppm	-0.08	4.4	-0.02
Cr ppm	2.21	156	0.01
Fe ppm	880	375,000	0.00
Mn ppm	563	547	1.0
Cu ppm	13.3	381	0.03
Zn ppm	24	146	0.2
Al ppm	137	23,000	0.01
Mo ppm	0.67	1.1	0.6
Co ppm	3.33	143	0.02
Hg ppm	---	0.018	---
V ppm	---	717	---

COMMON FLEABANE



VEGETATION: Fleabane (leaves, flowers, stems) (a)
TAILINGS TYPE: Smelting and Refining Residue

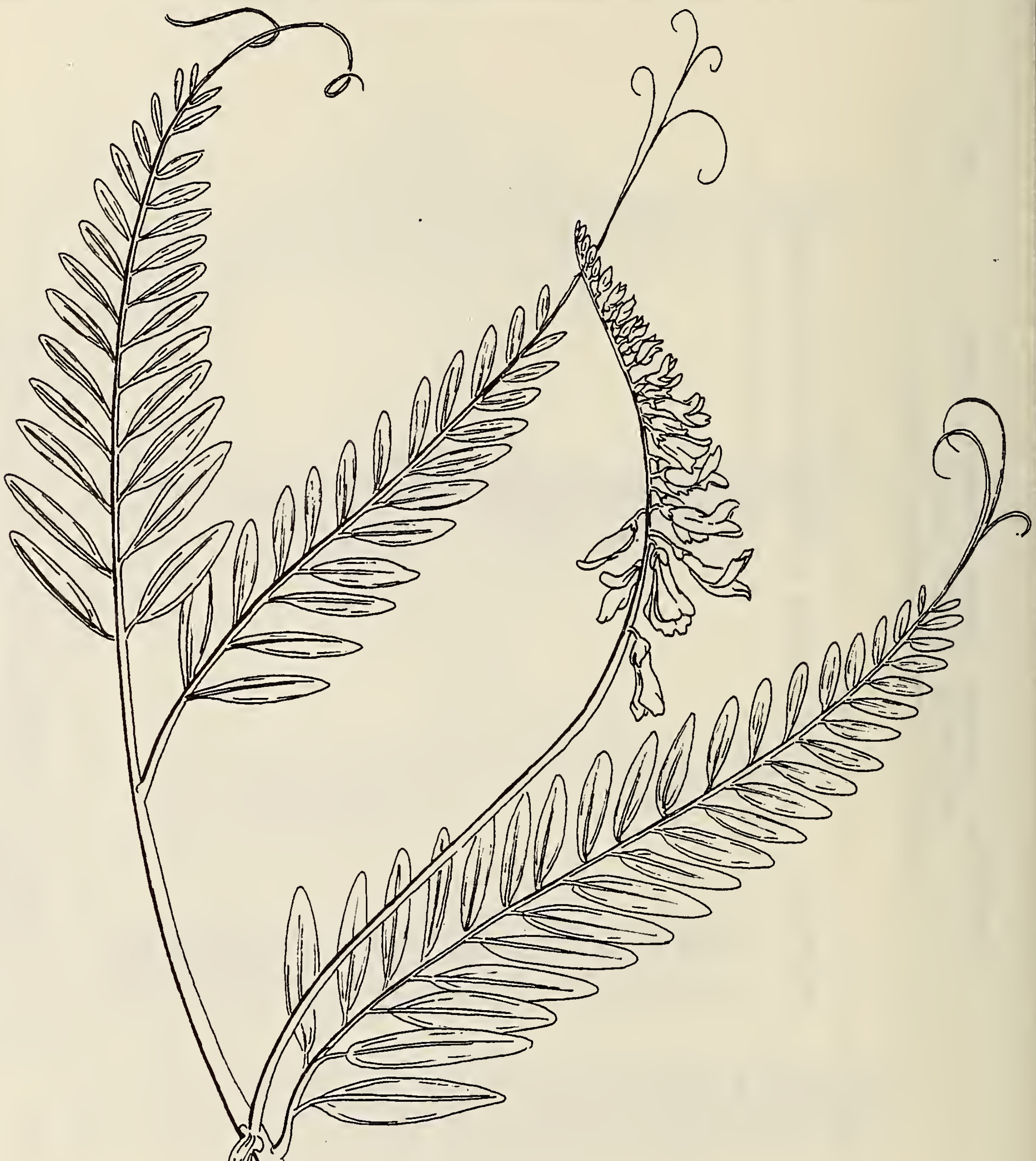
Parameter	Veg. Sample 123	Conc. in Tailings	Ratio Veg./Tail.
N ppm	32,000	20	1,600
P ppm	3,100	1,095	2.8
K ppm	27,000	300	90
Ca ppm	15,000	37,000	0.4
Mg ppm	4,300	30	143
Na ppm	400	260	1.5
S ppm	4,500	113,500	0.04
Se ppm	0.02	-0.5	=0.04
B ppm	87	-20	=4.4
As ppm	270	34,000	0.01
Ni ppm	34.63	1,485	0.02
Pb ppm	3.75	68	0.06
Cd ppm	-0.08	-2	-0.04
Cr ppm	1.18	186	0.01
Fe ppm	240	80,000	0.00
Mn ppm	144	42	3.4
Cu ppm	31	6,880	0.00
Zn ppm	72	250	0.3
Al ppm	62	550	0.1
Mo ppm	1.44	445	0.00
Co ppm	8.34	2,650	0.00
Hg ppm	0.106	0.42	0.25
V ppm	---	-8	---

VEGETATION: Fleabane (leaves, flowers, stems) (b)
BACKGROUND SAMPLES SUMMARY
Paleozoic Bedrock: Southern Ontario

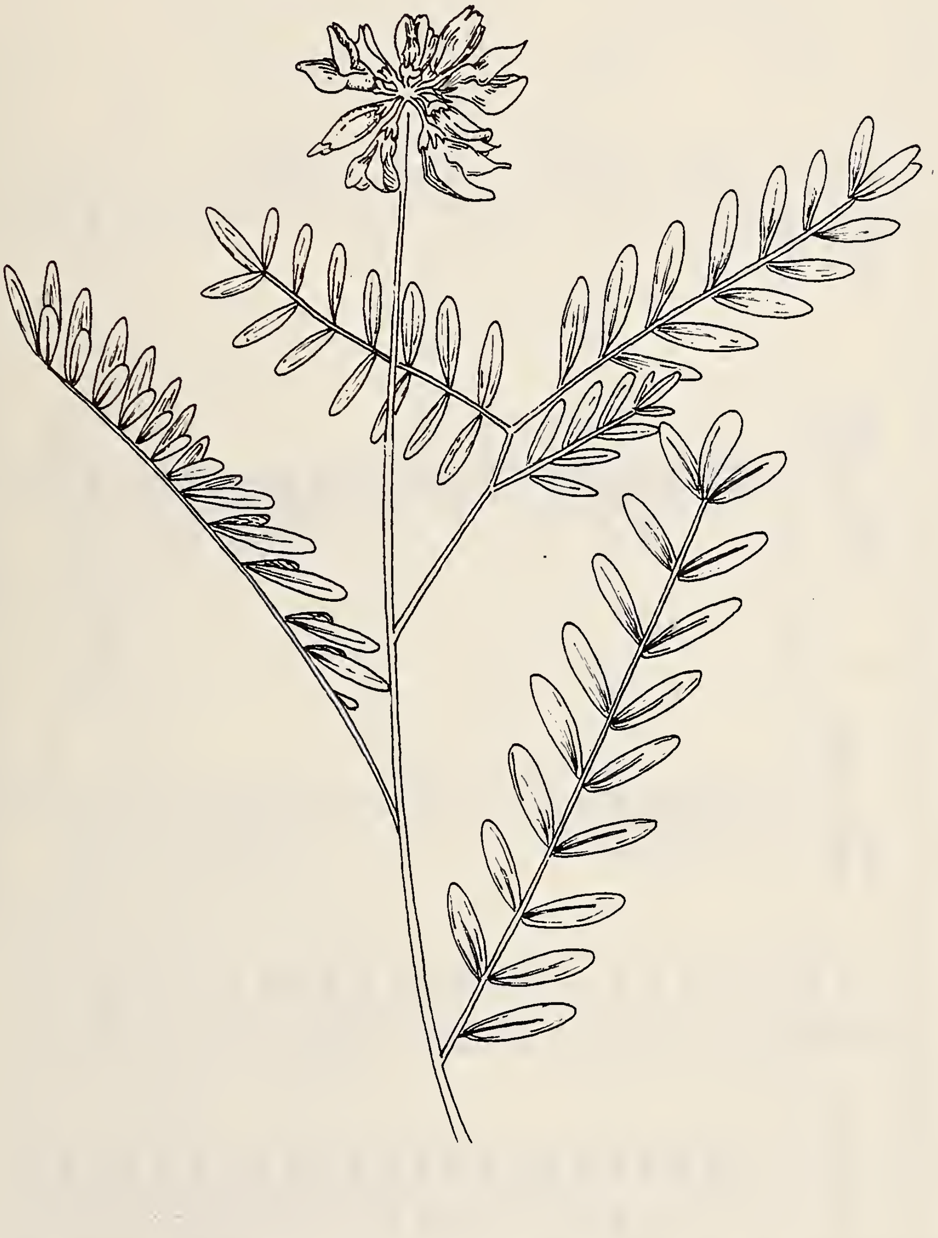
PARAMETER	AVERAGE CONCENTRATION (All Samples)
N ppm	23,000
P ppm	3,200
K ppm	25,600
Ca ppm	11,900
Mg ppm	3,500
Na ppm	300
S ppm	1,600
Se ppm	0.05
B ppm	57
As ppm	0.10
Ni ppm	0.71
Pb ppm	6.88
Cd ppm	0.42
Cr ppm	0.78
Fe ppm	70
Mn ppm	109
Cu ppm	21
Zn ppm	87
Al ppm	57
Mo ppm	0.55
Co ppm	0.64
Hg ppm	0.053

Note: Data based on two composite samples representing less than 25 individual plants.

TUFTED VETCH



CROWN-VETCH



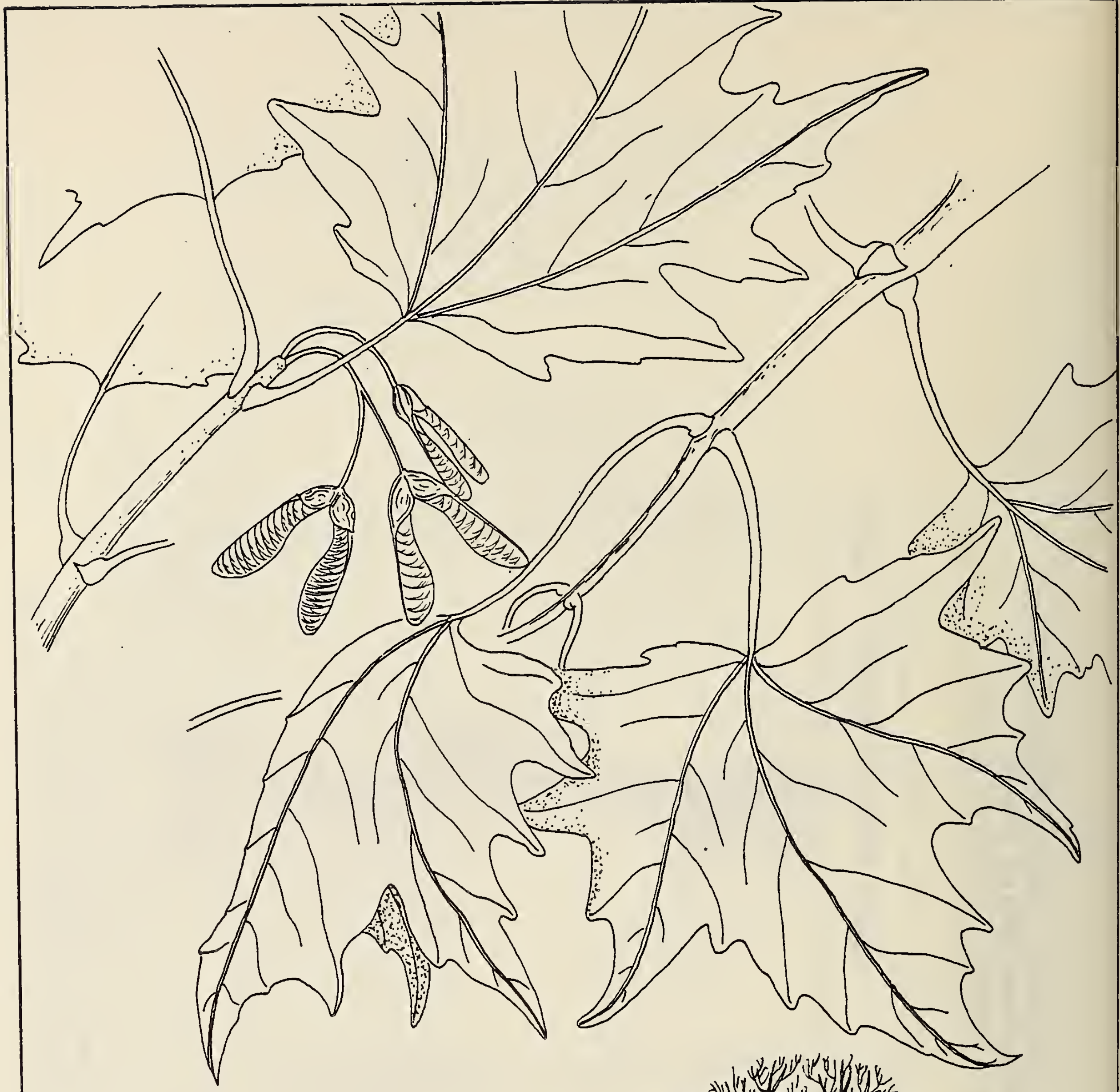
VEGETATION: Crown-Vetch (leaves, flowers, stems) (a)
TAILINGS TYPE: Sulphide (Acid) (Cu)

Parameter	Veg. Sample 54N	Conc. in Tailings	Ratio Veg./Tail.
N ppm	27,270	66	413
P ppm	2,610	788	3.3
K ppm	15,200	300	51
Ca ppm	48,000	14,200	3.4
Mg ppm	9,500	2,420	3.9
Na ppm	98	420	0.2
S ppm	3,800	6,900	0.6
Se ppm	-1	-0.5	-2
B ppm	---	-20	---
As ppm	-1	730	-0.00
Ni ppm	-3	24	-0.1
Pb ppm	19	273	0.07
Cd ppm	-1	-2	-0.5
Cr ppm	-5	21	-0.2
Fe ppm	170	191,900	0.00
Mn ppm	-50	1,310	-0.04
Cu ppm	12	50	0.2
Zn ppm	17	161	0.1
Al ppm	---	11,500	---
Mo ppm	---	-15	---
Co ppm	-2	12	-0.2
Hg ppm	---	0.21	---
V ppm	-6	40	-0.2

VEGETATION: Crown-Vetch (leaves, flowers, stems) (b)
BACKGROUND SAMPLES SUMMARY
Paleozoic Bedrock: Southern Ontario

PARAMETER	AVERAGE CONCENTRATION (All Samples)
N ppm	36,500
P ppm	2,500
K ppm	21,700
Ca ppm	19,300
Mg ppm	2,800
Na ppm	300
S ppm	1,800
Se ppm	0.05
B ppm	42
As ppm	0.07
Ni ppm	0.71
Pb ppm	7.50
Cd ppm	0.33
Cr ppm	0.74
Fe ppm	80
Mn ppm	90
Cu ppm	9.2
Zn ppm	48
Al ppm	57
Mo ppm	1.05
Co ppm	0.67
Hg ppm	0.062

Note: Data based on one composite sample of Tufted Vetch.



SUGAR MAPLE

Duignan

VEGETATION: Maple Leaves (a)
TAILINGS TYPE: Sulphide (Non-Acid) (Cu)

Parameter	Veg. Sample 33	Conc. in Tailings	Ratio Veg./Tail.
N ppm	23,000	24	958
P ppm	1,500	229	6.6
K ppm	18,800	15,750	1.2
Ca ppm	37,000	4,075	9.1
Mg ppm	2,800	302	9.3
Na ppm	1,100	11,030	0.1
S ppm	4,000	14,069	0.3
Se ppm	0.04	5	0.01
B ppm	185	102	1.8
As ppm	20	201	0.1
Ni ppm	9.28	-10	=0.9
Pb ppm	4.06	43	0.09
Cd ppm	-0.08	0.9	-0.09
Cr ppm	0.88	93	0.01
Fe ppm	180	44,200	0.00
Mn ppm	51	422	0.1
Cu ppm	6.3	549	0.01
Zn ppm	13	152	0.09
Al ppm	41	32,450	0.00
Mo ppm	10	2.2	4.5
Co ppm	3.50	54	0.06
Hg ppm	0.131	0.046	2.848
V ppm	---	99	---

VEGETATION: Maple Leaves (b)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 129	Conc. in Tailings	Ratio Veg./Tail.
N ppm	15,000	120	125
P ppm	1,000	1,200	0.8
K ppm	12,300	25,200	0.5
Ca ppm	21,400	2,560	8.4
Mg ppm	4,600	4,640	1
Na ppm	200	16,700	0.01
S ppm	4,500	6,893	0.7
Se ppm	0.17	-1	=0.17
B ppm	84	58	1.4
As ppm	4.60	592	0.01
Ni ppm	2.50	51	0.05
Pb ppm	4.38	9	0.5
Cd ppm	-0.08	0.8	-0.1
Cr ppm	0.60	108	0.01
Fe ppm	80	49,600	0.00
Mn ppm	158	621	0.3
Cu ppm	7.5	59	0.1
Zn ppm	35	138	0.3
Al ppm	52	25,900	0.00
Mo ppm	2.00	1.1	1.8
Co ppm	0.58	25	0.02
Hg ppm	0.087	0.121	0.719
V ppm	---	118	---

VEGETATION: Maple Leaves (c)
TAILINGS TYPE: Refinery Residue (high arsenic)

Parameter	Veg. Sample 125	Conc. in Tailings	Ratio Veg./Tail.
N ppm	23,000	20	1,150
P ppm	1,500	1,095	1.4
K ppm	18,800	300	63
Ca ppm	37,000	37,000	1
Mg ppm	2,800	30	93
Na ppm	1,100	260	4.2
S ppm	4,000	113,500	0.04
Se ppm	0.04	-0.5	=0.08
B ppm	185	-20	=9.3
As ppm	20	34,000	0.00
Ni ppm	9.28	1,485	0.01
Pb ppm	4.06	68	0.06
Cd ppm	-0.08	-2	-0.04
Cr ppm	0.88	186	0.00
Fe ppm	180	80,000	0.00
Mn ppm	51	42	1.2
Cu ppm	6.3	6,880	0.00
Zn ppm	13	250	0.05
Al ppm	41	550	0.07
Mo ppm	10	445	0.02
Co ppm	3.50	2,650	0.00
Hg ppm	0.131	0.42	0.31
V ppm	---	-8	---

VEGETATION: Maple Leaves (d)
BACKGROUND SAMPLES SUMMARY
Paleozoic Bedrock: Southern Ontario

PARAMETER	AVERAGE CONCENTRATION (All Samples)
N ppm	14,500
P ppm	1,200
K ppm	4,400
Ca ppm	23,400
Mg ppm	2,900
Na ppm	300
S ppm	1,700
Se ppm	0.06
B ppm	67
As ppm	0.06
Ni ppm	0.71
Pb ppm	3.29
Cd ppm	-0.08
Cr ppm	0.74
Fe ppm	60
Mn ppm	126
Cu ppm	8.2
Zn ppm	24
Al ppm	52
Mo ppm	1.4
Co ppm	0.79
Hg ppm	0.124

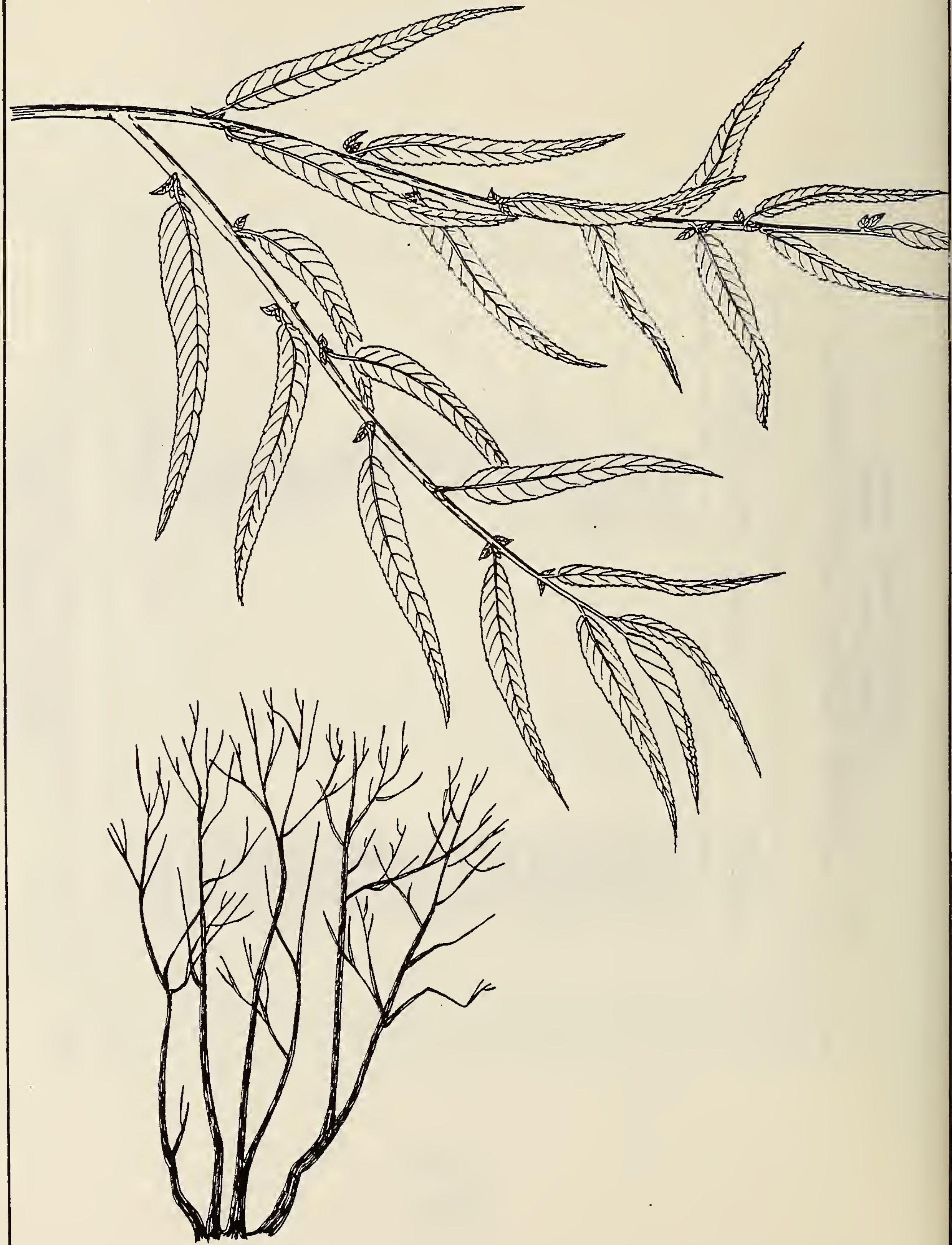
Note: Data based on two composite samples from two widely separated sites in Southern Ontario.

VEGETATION: Maple Leaves (e)
BACKGROUND SAMPLES SUMMARY
Precambrian Bedrock: Southern Ontario

PARAMETER	AVERAGE CONCENTRATION (All Samples)
N ppm	18,500
P ppm	1,400
K ppm	9,100
Ca ppm	16,000
Mg ppm	1,800
Na ppm	400
S ppm	2,500
Se ppm	-0.02
B ppm	56
As ppm	0.12
Ni ppm	0.71
Pb ppm	2.50
Cd ppm	0.30
Cr ppm	0.88
Fe ppm	70
Mn ppm	570
Cu ppm	3.9
Zn ppm	37
Al ppm	35
Mo ppm	0.14
Co ppm	0.60
Hg ppm	0.088

Note: Data based on one composite sample from a site in south-eastern Ontario.

BLACK WILLOW



Duignan

VEGETATION: Willow Leaves
TAILINGS TYPE: Gold (Non-Acid)

(a)

Parameter	Veg. Sample 83	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 95	Conc. in Tailings	Ratio Veg./Tail.
N ppm	22,500	47.5	474	12,500	14	893
P ppm	1,100	716	1.5	800	1,560	0.5
K ppm	17,200	40,700	0.4	7,700	38,100	0.2
Ca ppm	17,400	1,690	10.3	11,900	3,430	3.5
Mg ppm	8,300	3,310	2.5	5,600	8,770	0.6
Na ppm	300	19,100	0.02	200	17,600	0.01
S ppm	-13,000	10,223	-1.3	6,100	6,960	0.9
Se ppm	0.07	2	0.04	0.09	4	0.02
B ppm	260	42	6.2	75	101	0.7
As ppm	0.30	80	0.00	0.12	562	0.00
Ni ppm	11.42	90	0.1	20.71	-10	-2.1
Pb ppm	6.25	61	0.1	5	9	0.6
Cd ppm	1	0.3	3.3	1.08	0.6	1.8
Cr ppm	0.59	159	0.00	0.88	124	0.01
Fe ppm	140	31,500	0.00	100	47,000	0.00
Mn ppm	663	417	1.6	1,095	648	1.7
Cu ppm	9.4	50	0.2	10.5	76	0.1
Zn ppm	805	119	6.8	644	200	3.2
Al ppm	51	40,300	0.00	34	33,800	0.00
Mo ppm	21.3	4.4	4.8	27.5	1.6	17.2
Co ppm	1.17	16	0.07	2.58	13	0.2
Hg ppm	0.069	2.44	0.03	0.036	3.76	0.01
V ppm	---	199	---	---	114	---

VEGETATION: Willow Leaves (b)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 169	Conc. in Tailings	Ratio Veg./Tail.
N ppm	10,500	50.1	210
P ppm	600	349	1.7
K ppm	5,300	5,570	1
Ca ppm	8,900	5,380	1.7
Mg ppm	3,300	11,900	0.3
Na ppm	300	3,710	0.08
S ppm	1,700	4,629	0.4
Se ppm	0.03	-1	=0.03
B ppm	59	95	0.6
As ppm	0.40	1,090	0.00
Ni ppm	6.66	76	0.09
Pb ppm	0.90	13	0.07
Cd ppm	0.92	1.0	0.9
Cr ppm	0.75	77	0.01
Fe ppm	62	61,300	0.00
Mn ppm	179	1,281	0.1
Cu ppm	5.0	108	0.05
Zn ppm	196	147	1.3
Al ppm	15	11,900	0.00
Mo ppm	1.99	-0.6	==3.3
Co ppm	1.46	20	0.07
Hg ppm	0.029	0.165	0.176
V ppm	---	117	---

VEGETATION: Willow (Leaves) (c)
TAILINGS TYPE: Gold (Non-Acid)
SUMMARY: VEGETATION ANALYTICAL DATA

PARAMETER	AVERAGE CONCENTRATION All Samples	RANGE All Samples		AVERAGE RATIO VEG/TAIL. All Samples
		Low	High	
N ppm	15,167	10,500	22,500	526
P ppm	833	600	1,100	1.2
K ppm	10,067	5,300	17,200	0.5
Ca ppm	12,733	8,900	17,400	=2.6 ?
Mg ppm	5,733	3,300	8,300	1.1
Na ppm	267	200	300	0.04
S ppm	3,900	1,700	6,100	0.7
Se ppm	0.06	0.03	0.09	=0.03
B ppm	67	59	260	0.7
As ppm	0.27	0.12	0.40	0.00
Ni ppm	12.9	6.66	20.71	=0.8
Pb ppm	4	0.9	6.25	0.3
Cd ppm	1	0.92	1.08	2
Cr ppm	0.74	0.59	0.88	0.01
Fe ppm	67	62	140	0.00
Mn ppm	879	179	1,095	1.7
Cu ppm	8.3	5.0	10.5	0.1
Zn ppm	548	196	805	3.8
Al ppm	33	15	51	0.00
Mo ppm	24	1.99	27.5	=8.4
Co ppm	1.7	1.17	2.58	0.1
Hg ppm	0.045	0.029	0.069	0.07

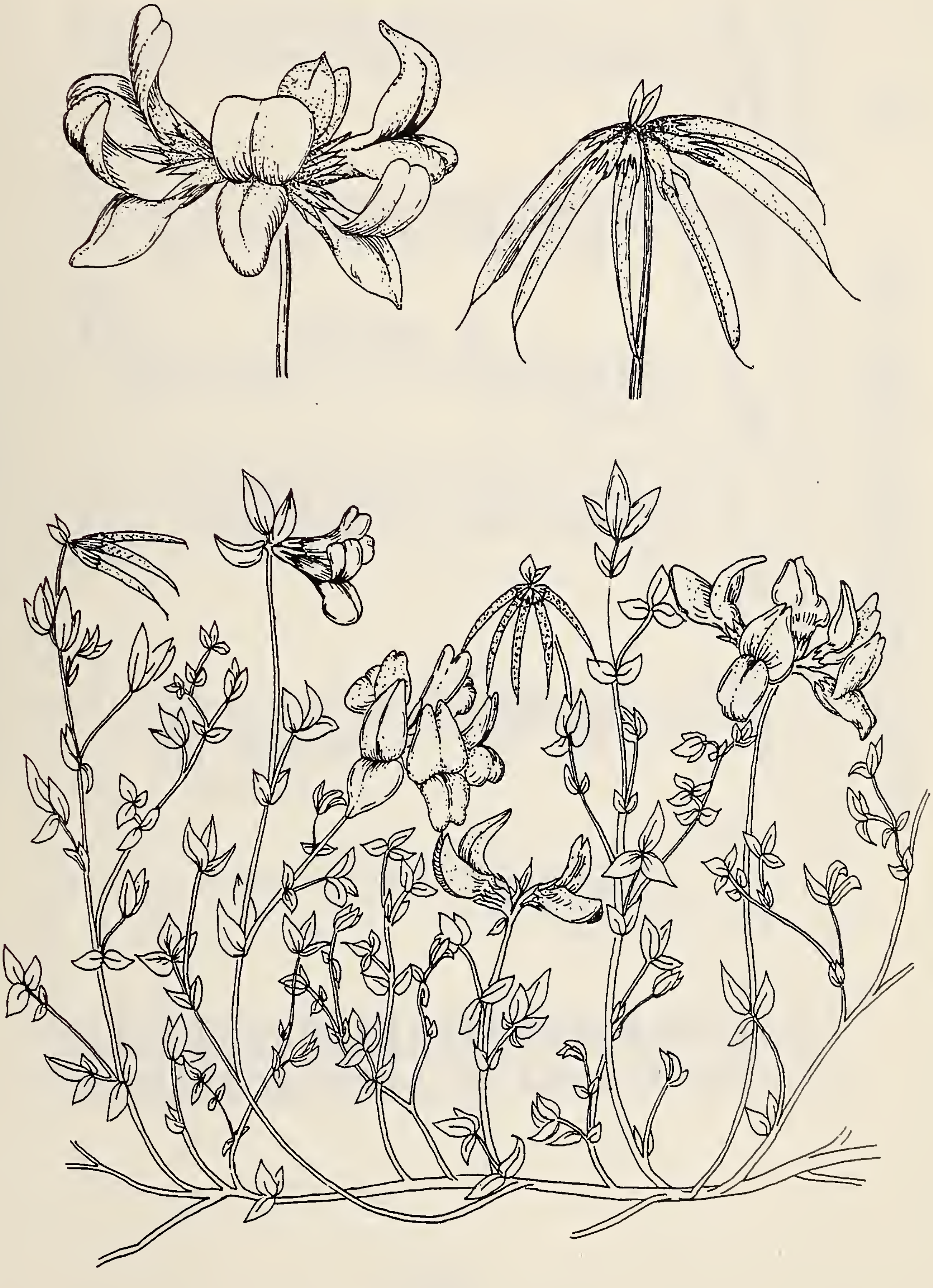
VEGETATION: Willow Leaves
BACKGROUND SAMPLES SUMMARY
Paleozoic Bedrock: Southern Ontario

(d)

PARAMETER	AVERAGE CONCENTRATION (All Samples)
N ppm	27,500
P ppm	2,100
K ppm	9,600
Ca ppm	21,400
Mg ppm	5,900
Na ppm	400
S ppm	5,600
Se ppm	0.09
B ppm	66
As ppm	0.08
Ni ppm	0.71
Pb ppm	7.50
Cd ppm	3.17
Cr ppm	0.94
Fe ppm	80
Mn ppm	322
Cu ppm	8.9
Zn ppm	379
Al ppm	60
Mo ppm	0.22
Co ppm	2.25
Hg ppm	0.068

Note: Data based on two composite samples from two widely separated sites in Southern Ontario. Less than 2,000 individual leaves are represented here.

BIRDSFOOT TREFOIL



VEGETATION: Trefoil (leaves, flowers, stems) (a)
TAILINGS TYPE: Uranium (Acid)

Parameter	Veg. Sample 25N	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 2	Conc. in Tailings	Ratio Veg./Tail.
N ppm	15,400	30	513	25,000	75.4	332
P ppm	1,450	78	18.6	1,700	48	35
K ppm	17,400	9,100	1.9	10,300	28,000	0.4
Ca ppm	26,500	1,600	16.6	12,500	97.8	128
Mg ppm	4,600	270	17	1,100	783	1.4
Na ppm	7	300	0.02	400	1,170	0.3
S ppm	2,000	20,500	0.1	1,400	4,662	0.3
Se ppm	-1	-0.5	-2	0.05	-1	=0.05
B ppm	---	-20	---	32	107	0.3
As ppm	2	15	0.1	0.08	137	0.00
Ni ppm	-3	9	-0.3	5.00	-10	=0.5
Pb ppm	4	110	0.04	1.87	23	0.08
Cd ppm	-1	-2	-0.5	-0.08	0.3	-0.3
Cr ppm	-5	12	-0.4	1.03	20	0.05
Fe ppm	190	17,600	0.01	60	11,100	0.01
Mn ppm	50	5	10	41	-10	=4.1
Cu ppm	9	16	0.6	40	39	1.03
Zn ppm	25	3	8.3	6.0	9.8	0.6
Al ppm	---	21,000	---	45	19,600	0.00
Mo ppm	---	-15	---	15.0	2.7	5.6
Co ppm	-2	14	-0.1	1.42	-1	=1.4
Hg ppm	---	0.04	---	0.066	0.06	1.10
V ppm	-6	10	-0.6	---	40	---

VEGETATION: Trefoil (leaves, flowers, stems) (b)
TAILINGS TYPE: Uranium (Acid)

Parameter	Veg. Sample 6	Conc. in Tailings	Ratio Veg./Tail.
N ppm	32,000	40	800
P ppm	2,300	180	12.8
K ppm	25,100	6,800	3.7
Ca ppm	11,900	6,850	1.7
Mg ppm	4,200	150	28
Na ppm	400	290	1.4
S ppm	1,400	53,400	0.03
Se ppm	0.02	1.0	0.02
B ppm	45	-20	=2.3
As ppm	0.08	15	0.01
Ni ppm	3.93	14	0.3
Pb ppm	2.19	245	0.01
Cd ppm	0.25	-2	=0.1
Cr ppm	1.47	15	0.1
Fe ppm	100	29,300	0.00
Mn ppm	698	10	69.8
Cu ppm	9.8	36	0.3
Zn ppm	56	13	4.3
Al ppm	60	23,100	0.00
Mo ppm	0.23	-15	=0.02
Co ppm	0.75	34	0.02
Hg ppm	0.051	0.10	0.51
V ppm	---	-10	---

VEGETATION: Trefoil (leaves, flowers, stems) (c)
TAILINGS TYPE: Silver (arsenic-bearing)

Parameter	Veg. Sample 7074	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 77	Conc. in Tailings	Ratio Veg./Tail.
N ppm	29,800	42	710	31,000	33.4	928
P ppm	1,850	524	3.5	2,700	564	4.8
K ppm	21,000	10,625	2	30,100	5,940	5.1
Ca ppm	14,100	4,965	2.8	15,600	3,070	5.1
Mg ppm	2,750	10,225	0.3	3,700	6,340	0.6
Na ppm	300	8,050	0.04	300	63,400	0.00
S ppm	2,350	5,345	0.4	3,800	2,594	1.5
Se ppm	-0.06	2	-0.03	0.07	-1	=0.07
B ppm	24	81	0.3	21	95	0.2
As ppm	19	7,665	0.00	12.4	41	0.3
Ni ppm	11.96	190	0.06	24.27	64	0.4
Pb ppm	1.88	27	0.07	3.44	11	0.3
Cd ppm	-0.08	1.2	-0.07	-0.08	0.6	-0.1
Cr ppm	1.18	238	0.00	1.47	119	0.01
Fe ppm	180	57,550	0.00	180	47,700	0.00
Mn ppm	51	1,054	0.05	53	455	0.1
Cu ppm	8.4	112	0.08	12.3	40	0.3
Zn ppm	25	107	0.2	54	99	0.5
Al ppm	56	19,900	0.00	115	47,400	0.00
Mo ppm	46.9	1.4	33.5	68.8	-0.6	=115
Co ppm	7.75	363	0.02	8.25	80	0.1
Hg ppm	0.050	0.972	0.05	0.087	0.581	0.150
V ppm	---	181	---	---	142	---

VEGETATION: Trefoil (leaves, flowers, stems) (d)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 66	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 175	Conc. in Tailings	Ratio Veg./Tail.
N ppm	29,000	83.4	348	38,000	61.2	621
P ppm	1,700	514	3.3	2,200	776	2.8
K ppm	16,500	5,950	2.8	19,500	35,000	0.6
Ca ppm	11,000	4,890	2.2	26,200	2,630	10
Mg ppm	9,100	11,100	0.8	3,200	5,160	0.6
Na ppm	200	16,300	0.01	200	22,000	0.01
S ppm	4,600	18,248	0.3	1,200	11,355	0.1
Se ppm	0.05	4	0.01	-0.01	-1	-0.01
B ppm	57	92	0.6	48	102	0.5
As ppm	0.80	825	0.00	---	117	---
Ni ppm	12.14	399	0.03	5.83	-10	=0.6
Pb ppm	1.88	14	0.1	2.00	11	0.2
Cd ppm	0.08	0.9	0.09	0.15	0.6	0.3
Cr ppm	0.88	566	0.00	1.90	107	0.02
Fe ppm	60	66,500	0.00	---	33,400	---
Mn ppm	34	1,360	0.03	124	379	0.3
Cu ppm	5.7	173	0.03	8.0	78	0.1
Zn ppm	56	355	0.2	20	87.5	0.2
Al ppm	32	9,310	0.00	250	41,700	0.01
Mo ppm	7.50	3,416	0.00	6.00	4.3	1.4
Co ppm	1.92	37	0.05	2.83	14	0.2
Hg ppm	0.042	0.198	0.212	0.029	0.201	0.144
V ppm	---	269	---	---	195	---

VEGETATION: Trefoil (leaves, flowers, stems) (e)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 49	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 46	Conc. in Tailings	Ratio Veg./Tail.
N ppm	21,500	72.6	296	24,000	27.8	863
P ppm	800	239	3.3	900	261	3.4
K ppm	13,400	19,300	0.7	14,100	1,170	12.1
Ca ppm	20,500	6,280	3.3	14,000	486	28.8
Mg ppm	5,500	11,500	0.5	9,500	2,330	4.1
Na ppm	300	4,490	0.07	300	875	0.3
S ppm	1,100	8,392	0.1	300	8,991	0.03
Se ppm	0.05	2	0.03	0.07	5	0.01
B ppm	---	92	---	43	82	0.5
As ppm	0.60	90	0.01	1.80	1,310	0.00
Ni ppm	3.22	-10	=0.3	7.14	-10	=0.7
Pb ppm	1.88	15	0.1	---	3,160	---
Cd ppm	0.08	0.3	0.3	---	18.3	---
Cr ppm	0.88	219	0.00	1.18	39	0.03
Fe ppm	200	63,400	0.00	6.40	348,000	0.00
Mn ppm	210	907	0.2	140	97	1.4
Cu ppm	7.8	120	0.07	10.8	1,860	0.01
Zn ppm	40	229	0.2	115	4,070	0.03
Al ppm	93	29,100	0.00	127	4,090	0.03
Mo ppm	56.3	0.6	93.8	11.30	-0.6	=18.8
Co ppm	1.42	25	0.06	1.67	74	0.02
Hg ppm	0.069	0.153	0.451	0.091	0.017	5.4
V ppm	---	399	---	---	28	---

VEGETATION: Trefoil (leaves, flowers, stems) (f)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 3840	Conc. in Tailings	Ratio Veg./Tail.
N ppm	25,500	64.1	398
P ppm	1,250	473	2.6
K ppm	16,200	14,500	1.1
Ca ppm	11,750	4,100	2.9
Mg ppm	5,600	8,390	0.7
Na ppm	300	4,880	0.06
S ppm	1,050	21,711	0.05
Se ppm	0.03	-1	=0.03
B ppm	21.5	84	0.3
As ppm	0.33	820	0.00
Ni ppm	3.40	-10	=0.3
Pb ppm	4.69	70	0.07
Cd ppm	-0.12	8.0	-0.02
Cr ppm	1.33	78	0.02
Fe ppm	200	58,300	0.00
Mn ppm	98	1,350	0.07
Cu ppm	7.3	98	0.07
Zn ppm	54	351	0.2
Al ppm	73	20,200	0.00
Mo ppm	0.93	-0.6	=1.6
Co ppm	1.00	30	0.03
Hg ppm	0.051	0.010	5.1
V ppm	---	140	---

VEGETATION: Trefoil (leaves, flowers, stems) (g)
TAILINGS TYPE: Gold (Non-Acid)
SUMMARY: VEGETATION ANALYTICAL DATA

PARAMETER	AVERAGE CONCENTRATION All Samples	RANGE All Samples Low	High	AVERAGE RATIO VEG/TAIL. All Samples
N ppm	27,600	21,500	38,000	505
P ppm	1,370	800	2,200	3.1
K ppm	15,940	13,400	19,500	1.3
Ca ppm	16,690	11,000	26,200	2.8
Mg ppm	6,580	3,200	9,500	0.7
Na ppm	260	200	300	0.04
S ppm	1,117	300	4,600	0.1
Se ppm	-0.04	-0.01	0.07	0.02
B ppm	42.4	21.5	57	0.5
As ppm	0.88	0.33	1.80	0.00
Ni ppm	6.0	3.22	12.14	=0.4
Pb ppm	2.61	1.88	4.69	0.1
Cd ppm	-0.11	0.08	0.15	-0.2
Cr ppm	1.23	0.88	1.90	0.01
Fe ppm	153	6.40	200	0.00
Mn ppm	121	34	210	0.4
Cu ppm	7.9	5.7	10.8	0.06
Zn ppm	57	20	115	0.2
Al ppm	81	32	250	0.01
Mo ppm	8.3	0.93	56.3	range 1.5 to 94
Co ppm	1.77	1.00	2.83	0.07
Hg ppm	0.056	0.029	0.091	range 0.3 to 5.3
V ppm	---	---	---	---

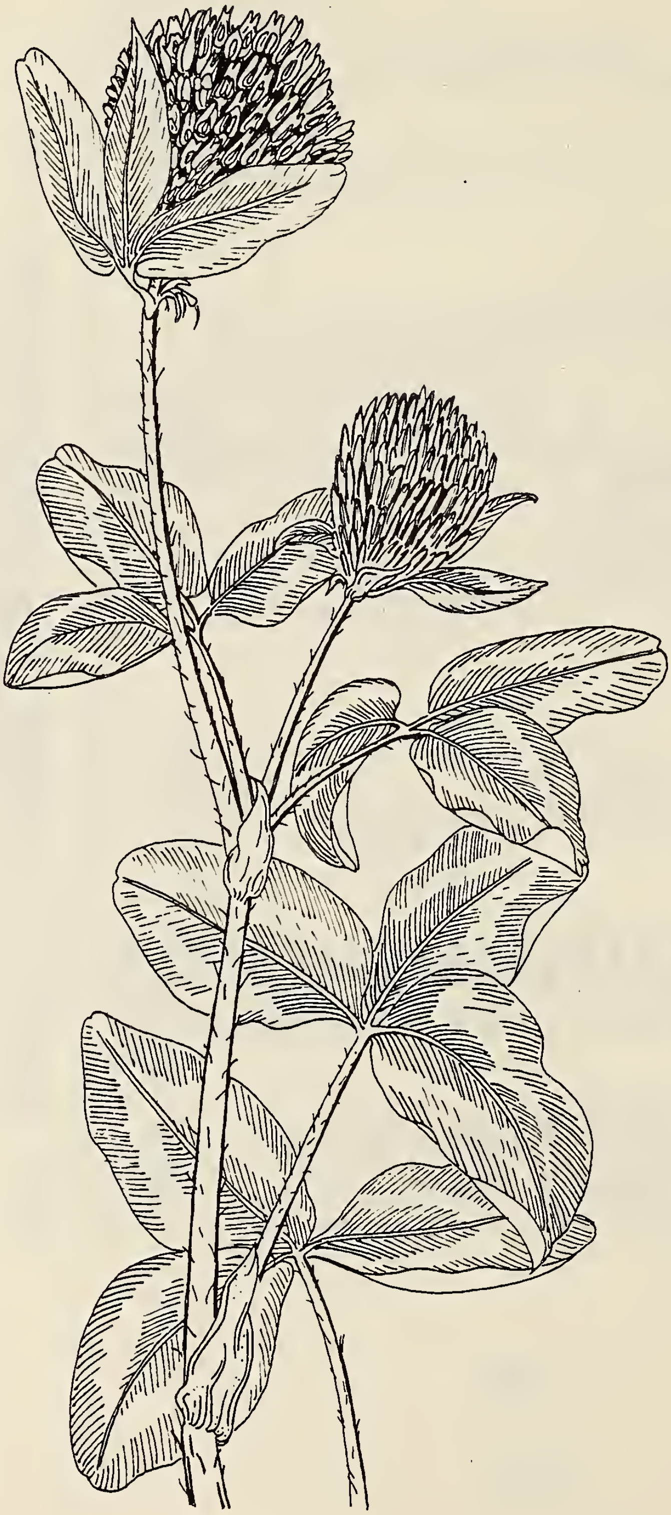
Note: Data based on 6 composite samples representing less than 100 individual plants.

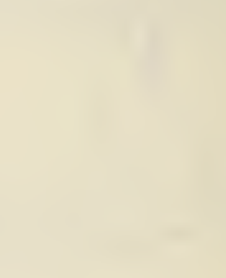
VEGETATION: Trefoil (leaves, flowers, stems) (h)
BACKGROUND SAMPLES SUMMARY
Paleozoic Bedrock: Southern Ontario

PARAMETER	AVERAGE CONCENTRATION (All Samples)
N ppm	46,000
P ppm	3,900
K ppm	41,700
Ca ppm	22,200
Mg ppm	2,800
Na ppm	200
S ppm	3,900
Se ppm	0.03
B ppm	59
As ppm	0.05
Ni ppm	3.93
Pb ppm	5.00
Cd ppm	0.08
Cr ppm	1.03
Fe ppm	160
Mn ppm	113
Cu ppm	14.7
Zn ppm	56
Al ppm	66
Mo ppm	2.17
Co ppm	0.99
Hg ppm	0.062

Note: Data based on one composite sample from Southern Ontario. Less than 50 individual plants are represented.

PURPLE CLOVER





VEGETATION: Purple Clover (leaves, flowers, stems) (a)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 45	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 50	Conc. in Tailings	Ratio Veg./Tail.
N ppm	26,500	27.8	953	27,000	72.6	372
P ppm	1,400	261	5.4	1,400	239	5.9
K ppm	21,500	1,170	18.4	18,700	19,300	0.9
Ca ppm	10,200	486	21	12,200	6,280	1.9
Mg ppm	6,900	2,330	3	3,900	11,500	0.3
Na ppm	300	875	0.3	300	4,490	0.07
S ppm	200	8,991	0.02	300	8,392	0.04
Se ppm	0.13	5	0.03	0.05	2	0.03
B ppm	32	82	0.4	27	92	0.3
As ppm	3.50	1,310	0.00	0.70	90	0.01
Ni ppm	5.71	-10	=0.6	3.93	-10	=0.4
Pb ppm	51.25	3,160	0.02	1.88	15	0.13
Cd ppm	3	18.3	0.2	-0.08	0.3	-0.3
Cr ppm	1.47	39	0.04	1.17	219	0.01
Fe ppm	1,380	348,000	0.00	450	63,400	0.01
Mn ppm	84	97	0.9	77	907	0.08
Cu ppm	24.4	1,860	0.01	11.6	120	0.1
Zn ppm	239	4,070	0.06	33	229	0.1
Al ppm	183	4,090	0.04	155	29,100	0.01
Mo ppm	1.18	-0.6	=2	41.3	0.6	69
Co ppm	2.50	74	0.03	1.83	25	0.07
Hg ppm	0.178	0.017	10.5	0.047	0.153	0.307
V ppm	---	28	---	---	399	---

VEGETATION: Purple Clover (leaves, flowers, stems) (b)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 118	Conc. in Tailings	Ratio Veg./Tail.
N ppm	32,500	19.5	1,667
P ppm	2,000	157	12.7
K ppm	27,900	10,600	2.6
Ca ppm	17,800	2,440	7.3
Mg ppm	2,300	5,270	0.4
Na ppm	300	13,800	0.02
S ppm	1,900	4,496	0.4
Se ppm	0.03	-1	=0.03
B ppm	40	100	0.4
As ppm	0.09	59	0.00
Ni ppm	10	-10	≐1
Pb ppm	3.80	17	0.22
Cd ppm	0.17	0.3	0.6
Cr ppm	0.59	68	0.01
Fe ppm	70	15,500	0.00
Mn ppm	60	107	0.6
Cu ppm	12.6	39	0.3
Zn ppm	58	48.8	1.2
Al ppm	37	28,600	0.00
Mo ppm	79.3	2.1	37.8
Co ppm	0.67	20	0.03
Hg ppm	0.033	0.020	1.650
V ppm	---	78	---

VEGETATION: Purple Clover (leaves, flowers, stems) (c)
TAILINGS TYPE: Gold (Non-Acid)
SUMMARY: VEGETATION ANALYTICAL DATA

PARAMETER	AVERAGE CONCENTRATION All Samples	RANGE All Samples Low	High	AVERAGE RATIO VEG/TAIL. All Samples
N ppm	28,667	26,500	32,500	663
P ppm	1,600	1,400	2,000	5.7
K ppm	22,700	18,700	27,900	variable
Ca ppm	13,400	10,200	17,800	variable
Mg ppm	4,367	2300	6,900	0.4
Na ppm	300	300	300	0.1
S ppm	250	200	1,900	0.03
Se ppm	0.07	0.03	0.13	=0.03
B ppm	33	27	40	0.4
As ppm	0.4	0.09	3.50	0.00
Ni ppm	6.5	3.93	10	=0.7
Pb ppm	2.8	1.88	51.25	0.1
Cd ppm	-1.1	-0.08	3	-0.4
Cr ppm	1.08	0.59	1.47	0.02
Fe ppm	variable	70	1,380	0.00
Mn ppm	74	60	84	0.5
Cu ppm	12.1	11.6	24.4	0.1
Zn ppm	46	33	239	0.1
Al ppm	125	37	183	0.02
Mo ppm	60	1.18	79.3	53
Co ppm	1.7	0.67	2.50	0.04
Hg ppm	0.086	0.033	0.178	1

Note: Results based on 3 composite samples representing less than 30 plants.

VEGETATION: Purple Clover (leaves, flowers, stems) (d)
TAILINGS TYPE: Sulphide (Acid) (Cu, Ni)

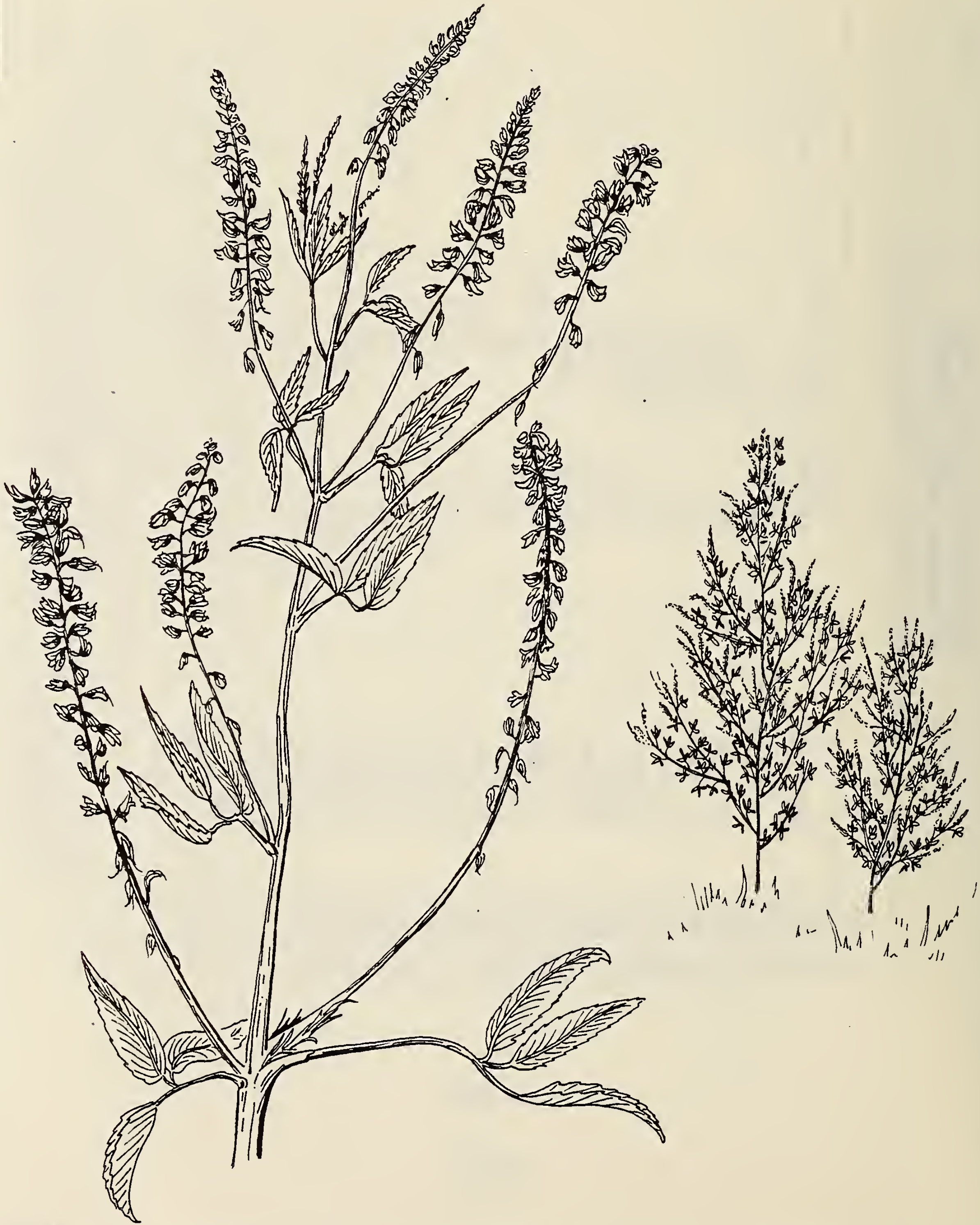
Parameter	Veg. Sample 22	Conc. in Tailings
N ppm	36,000	Not Available
P ppm	2,800	
K ppm	20,400	
Ca ppm	10,300	
Mg ppm	2,000	
Na ppm	300	
S ppm	1,800	
Se ppm	0.03	
B ppm	16	
As ppm	0.04	
Ni ppm	12.21	
Pb ppm	2.50	
Cd ppm	-0.08	
Cr ppm	1.03	
Fe ppm	8.5	
Mn ppm	78	
Cu ppm	20.0	
Zn ppm	26	
Al ppm	50	
Mo ppm	1.06	
Co ppm	1.08	
Hg ppm	0.055	
V ppm	---	

VEGETATION: Purple Clover (e)
BACKGROUND SAMPLES SUMMARY
Paleozoic Bedrock: Southern Ontario

PARAMETER	AVERAGE CONCENTRATION (All Samples)
N ppm	37,000
P ppm	2,700
K ppm	21,700
Ca ppm	24,600
Mg ppm	5,300
Na ppm	300
S ppm	1,600
Se ppm	0.03
B ppm	34
As ppm	0.12
Ni ppm	0.71
Pb ppm	5.9
Cd ppm	-0.4
Cr ppm	0.81
Fe ppm	145
Mn ppm	57
Cu ppm	13.6
Zn ppm	39
Al ppm	98
Mo ppm	1.9
Co ppm	0.52
Hg ppm	0.049

Note: Results based on two composite samples representing a total of less than 30 plants. Sites of collection separated by approx. 100 kilometers.

YELLOW SWEET CLOVER



VEGETATION: Yellow Sweet Clover (leaves, flowers, stems) (a)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 32N	Conc. in Tailings	Ratio Veg./Tail.
N ppm	15,780	19.5	809
P ppm	2,250	157	14
K ppm	14,300	10,600	1.3
Ca ppm	25,000	2,440	10
Mg ppm	2,900	5,270	0.6
Na ppm	-4	13,800	-0.00
S ppm	4,900	4,496	1.1
Se ppm	-1	-1	-1
B ppm	28	100	0.28
As ppm	6	59	0.1
Ni ppm	-3	-10	-0.3
Pb ppm	10	17	0.6
Cd ppm	-1	0.3	-3.3
Cr ppm	-5	68	-0.1
Fe ppm	320	15,500	0.02
Mn ppm	-50	107	-0.5
Cu ppm	7	39	0.2
Zn ppm	35	48.8	0.7
Al ppm	38	28,600	0.00
Mo ppm	28	2.1	13.3
Co ppm	-2	20	-0.1
Hg ppm	0.040	0.020	2.000
V ppm	-6	78	-0.1

VEGETATION: Yellow Sweet Clover (leaves, flowers, stems) (b)
TAILINGS TYPE: Acid Sulphide (A-Cu, Ni)
(B-Cu, Pb, Zn)

Parameter	Veg. Sample 12(A)	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 37N(B)	Conc. in Tailings	Ratio Veg./Tail.
N ppm	35,000	5.6	6,250	20,580	16.8	1,225
P ppm	4,600	477	9.6	1,180	400	2.95
K ppm	14,500	4,660	3.1	3,000	10,100	0.3
Ca ppm	24,500	9,420	2.6	21,000	793	26
Mg ppm	4,000	20,000	0.2	3,000	7,730	0.4
Na ppm	200	7,930	0.03	116	8,130	0.01
S ppm	2,200	22,211	0.1	2,000	17,383	0.1
Se ppm	0.10	3	0.03	-1	-1	-1
B ppm	14	265	0.05	---	103	---
As ppm	0.58	198	0.00	-1	20	-0.05
Ni ppm	20.7	527	0.04	-3	-10	-0.3
Pb ppm	4.38	60	0.07	22	226	0.1
Cd ppm	0.33	9.0	0.04	4	1.9	2.1
Cr ppm	1.47	228	0.01	-5	50	-0.1
Fe ppm	100	115,000	0.00	850	110,000	0.01
Mn ppm	36	962	0.04	-50	357	-0.1
Cu ppm	17.9	278	0.1	89	1,110	0.08
Zn ppm	19	139	0.1	670	4,940	0.1
Al ppm	63	16,600	0.00	---	32,200	---
Mo ppm	0.68	0.6	1.1	---	-0.6	---
Co ppm	1.33	34	0.04	-2	3	-0.7
Hg ppm	0.036	0.063	0.571	---	0.029	---
V ppm	---	1,350	---	-6	-40	-0.2

VEGETATION: Yellow Sweet Clover (leaves, flowers, stems) (c)
TAILINGS TYPE: Acid Sulphides (Cu)

Parameter	Veg. Sample 2N	Conc. in Tailings	Ratio Veg./Tail.
N ppm	16,270	32	508
P ppm	2,000	124	16
K ppm	11,900	650	18
Ca ppm	14,200	3,775	3.8
Mg ppm	2,500	1,150	2.2
Na ppm	-4	880	-0.00
S ppm	9,200	16,150	0.6
Se ppm	-1	10.8	-0.1
B ppm	---	-20	---
As ppm	4	670	0.01
Ni ppm	7	20	0.4
Pb ppm	15	14	1.1
Cd ppm	-1	-2	-05
Cr ppm	-5	24	-0.2
Fe ppm	600	79,600	0.01
Mn ppm	-5	99	-0.1
Cu ppm	13	643	0.02
Zn ppm	16	28	0.6
Al ppm	---	12,250	---
Mo ppm	---	-15	---
Co ppm	-2	115	-0.02
Hg ppm	---	0.10	---
V ppm	-6	35	-0.2

VEGETATION: Yellow Sweet Clover (leaves, flowers, stems) (d)
TAILINGS TYPE: Acid Sulphides
SUMMARY: VEGETATION ANALYTICAL DATA

PARAMETER	AVERAGE CONCENTRATION All Samples	RANGE All Samples Low	High	AVERAGE RATIO VEG/TAIL. All Samples
N ppm	23,950	16,270	35,000	867
P ppm	2,593	1,180	4,600	9.5
K ppm	13,200	3,000	14,500	variable
Ca ppm	19,900	14,200	24,500	3.2
Mg ppm	3,167	2,500	4,000	0.9
Na ppm	158	-4 ?	200	0.01
S ppm	2,100	2,000	9,200	0.3
Se ppm	-0.7	0.1	-1	-0.1
B ppm	---	insufficient	data	---
As ppm	-1.9	0.58	4	-0.02
Ni ppm	-10 ?	-3	20.7	-0.2
Pb ppm	14	4.38	22	0.4
Cd ppm	-0.7	0.33	4	-1.3
Cr ppm	-3.8	1.47	-5	-0.1
Fe ppm	517	100	850	0.01
Mn ppm	-43	-5	50	-0.07
Cu ppm	15 ?	13	89	0.07
Zn ppm	18 ?	16	670	0.3
Al ppm	---	insufficient	data	---
Mo ppm	---	insufficient	data	---
Co ppm	-1.8	1.33	-2	-0.3
Hg ppm	---	insufficient	data	---

Note: Results based on three composite samples representing less than 60 individual plants.

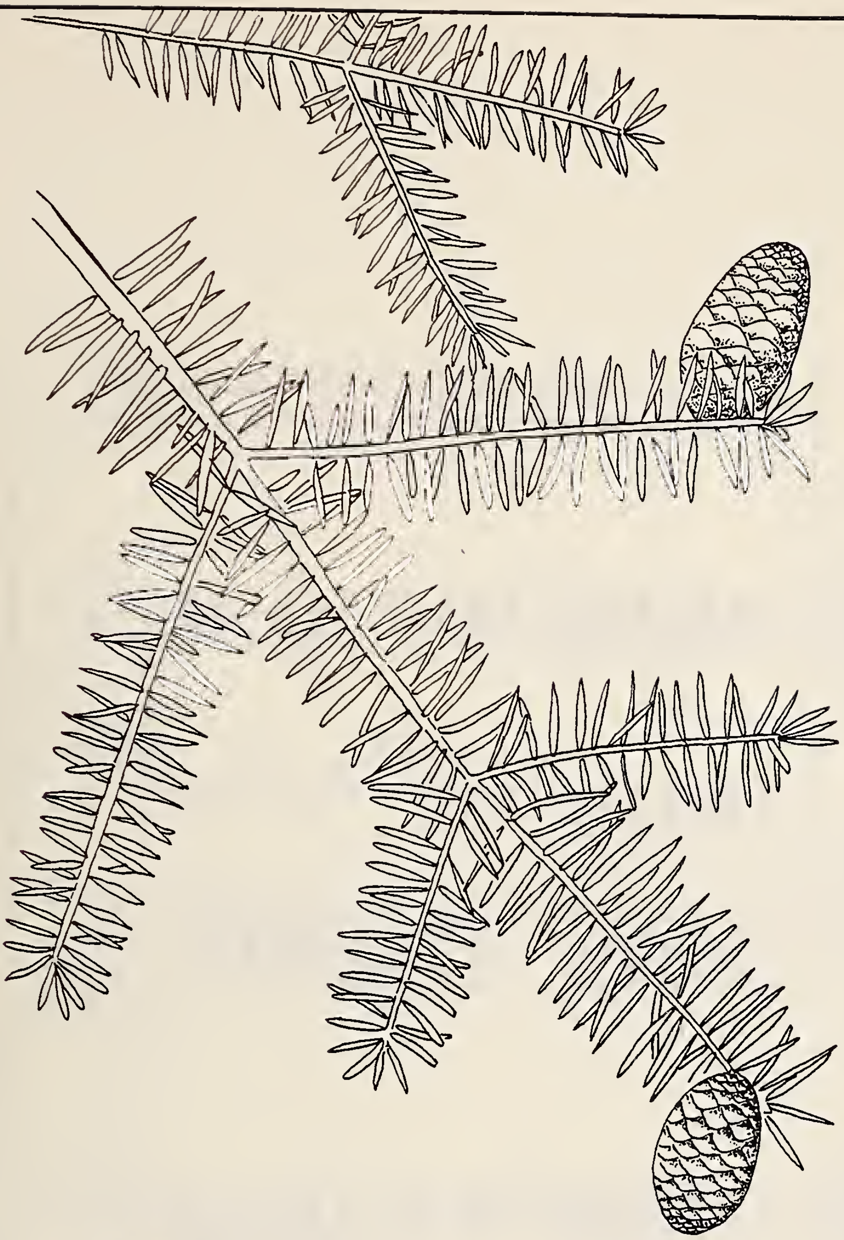
VEGETATION: Yellow Sweet Clover (leaves, flowers, stems) (e)
TAILINGS TYPE: Uranium (Acid)

Parameter	Veg. Sample 55N	Conc. in Tailings	Ratio Veg./Tail.
N ppm	36,800	75.4	488
P ppm	4,220	48	88
K ppm	19,100	28,000	0.7
Ca ppm	24,000	97.8	245
Mg ppm	6,500	783	8.3
Na ppm	98	1,170	0.08
S ppm	6,200	4,662	1.3
Se ppm	-1	-1	-1
B ppm	---	107	---
As ppm	-1	137	0.01
Ni ppm	9	-10	=0.9
Pb ppm	7	23	0.3
Cd ppm	-1	0.3	-3.3
Cr ppm	-5	20	-0.3
Fe ppm	150	11,100	0.01
Mn ppm	-50	-10	=5.0
Cu ppm	21	39	0.5
Zn ppm	22	9.8	2.2
Al ppm	---	19,600	---
Mo ppm	---	2.7	---
Co ppm	-2	-1	-2
Hg ppm	---	0.06	---
V ppm	-6	40	-0.2

VEGETATION: *White Sweet Clover (leaves, flowers, stems) (f)
BACKGROUND SAMPLES SUMMARY
Paleozoic Bedrock: Southern Ontario

PARAMETER	AVERAGE CONCENTRATION (All Samples)
N ppm	32,000
P ppm	3,700
K ppm	15,200
Ca ppm	14,400
Mg ppm	2,800
Na ppm	600
S ppm	1,500
Se ppm	0.05
B ppm	27
As ppm	0.07
Ni ppm	0.71
Pb ppm	2.50
Cd ppm	-0.08
Cr ppm	0.59
Fe ppm	80
Mn ppm	28
Cu ppm	9.5
Zn ppm	31
Al ppm	50
Mo ppm	0.36
Co ppm	0.88
Hg ppm	0.058
V ppm	---

* Note: Background samples of yellow sweet clover were not obtained. This background sample from Southern Ontario is white sweet clover (a very close relative of yellow sweet clover). However, comparisons between the two may not be valid. The one composite sample reported here represents less than 20 individual plants.



BALSAM FIR

VEGETATION: Evergreen Needles (a)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 29N	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 167	Conc. in Tailings	Ratio Veg./Tail.
N ppm	5,360	35	153	14,500	15	967
P ppm	640	69	9.3	700	100	7
K ppm	6,800	5,400	1.3	3,700	600	6.2
Ca ppm	22,800	8,950	2.5	5,600	13,750	0.4
Mg ppm	1,600	600	2.7	2,700	2,730	1
Na ppm	-4	2,100	-0.00	200	350	0.6
S ppm	4,500	2,900	1.6	500	18,000	0.03
Se ppm	-1	-0.5	-2	0.01	0.5	0.02
B ppm	---	-20	---	25	-20	=1.3
As ppm	3	850	0.00	280	3,400	0.08
Ni ppm	-3	31	-0.1	0.80	28	0.03
Pb ppm	6	46	0.1	3.30	265	0.01
Cd ppm	-1	-2	-0.5	-0.08	-2	-0.04
Cr ppm	-5	45	-0.1	0.70	38	0.02
Fe ppm	50	22,400	0.00	715	183,600	0.00
Mn ppm	100	363	0.3	73	1,563	0.05
Cu ppm	2	34	0.06	6.00	78	0.08
Zn ppm	132	50	2.6	119	137	0.9
Al ppm	---	20,000	---	60	11,400	0.01
Mo ppm	---	-15	---	0.20	-15	=0.01
Co ppm	-2	12	-0.2	0.49	11	0.04
Hg ppm	---	0.21	---	0.033	0.57	0.06
V ppm	-6	30	-0.2	---	60	---

Note: 29N Spruce Needles
167 Fir Needles

VEGETATION: Evergreen Needles
TAILINGS TYPE: Gold (Non-Acid)

(b)

Parameter	Veg. Sample 42	Conc. in Tailings	Ratio Veg./Tail.
N ppm	1,500	64.1	23.4
P ppm	900	473	1.9
K ppm	3,300	14,500	0.2
Ca ppm	3,600	4,100	0.9
Mg ppm	1,900	8,390	0.2
Na ppm	300	4,880	0.06
S ppm	100	21,711	0.00
Se ppm	0.11	-1	=0.1
B ppm	17	84	0.2
As ppm	0.60	820	0.00
Ni ppm	0.71	-10	=0.07
Pb ppm	7.50	70	0.1
Cd ppm	0.17	8.0	0.02
Cr ppm	0.59	78	0.01
Fe ppm	180	58,300	0.00
Mn ppm	144	1,350	0.1
Cu ppm	4.10	98	0.04
Zn ppm	51	351	0.1
Al ppm	72	20,200	0.00
Mo ppm	0.06	-0.6	=0.1
Co ppm	0.50	30	0.02
Hg ppm	0.055	0.010	5.5
V ppm	---	140	---

Note: 42 Pine Needles

VEGETATION: Evergreen Needles (c)
TAILINGS TYPE: Uranium (Non-Acid)

Parameter	Veg. Sample 4N	Conc. in Tailings	Ratio Veg./Tail.
N ppm	14,380	15	959
P ppm	1,040	265	3.9
K ppm	6,300	16,900	0.4
Ca ppm	17,400	26,010	0.7
Mg ppm	1,900	1,690	1.1
Na ppm	-4	19,300	-0.00
S ppm	4,500	18,100	0.2
Se ppm	-1	-0.5	-2
B ppm	---	-20	---
As ppm	2	15	0.1
Ni ppm	-3	24	-0.1
Pb ppm	5	180	0.03
Cd ppm	-1	-2	-0.5
Cr ppm	-5	21	-0.2
Fe ppm	90	30,200	0.00
Mn ppm	550	845	0.7
Cu ppm	6	50	0.1
Zn ppm	108	222	0.5
Al ppm	---	50,200	---
Mo ppm	---	35	---
Co ppm	-2	23	-0.09
Hg ppm	---	0.09	---
V ppm	-6	40	-0.2

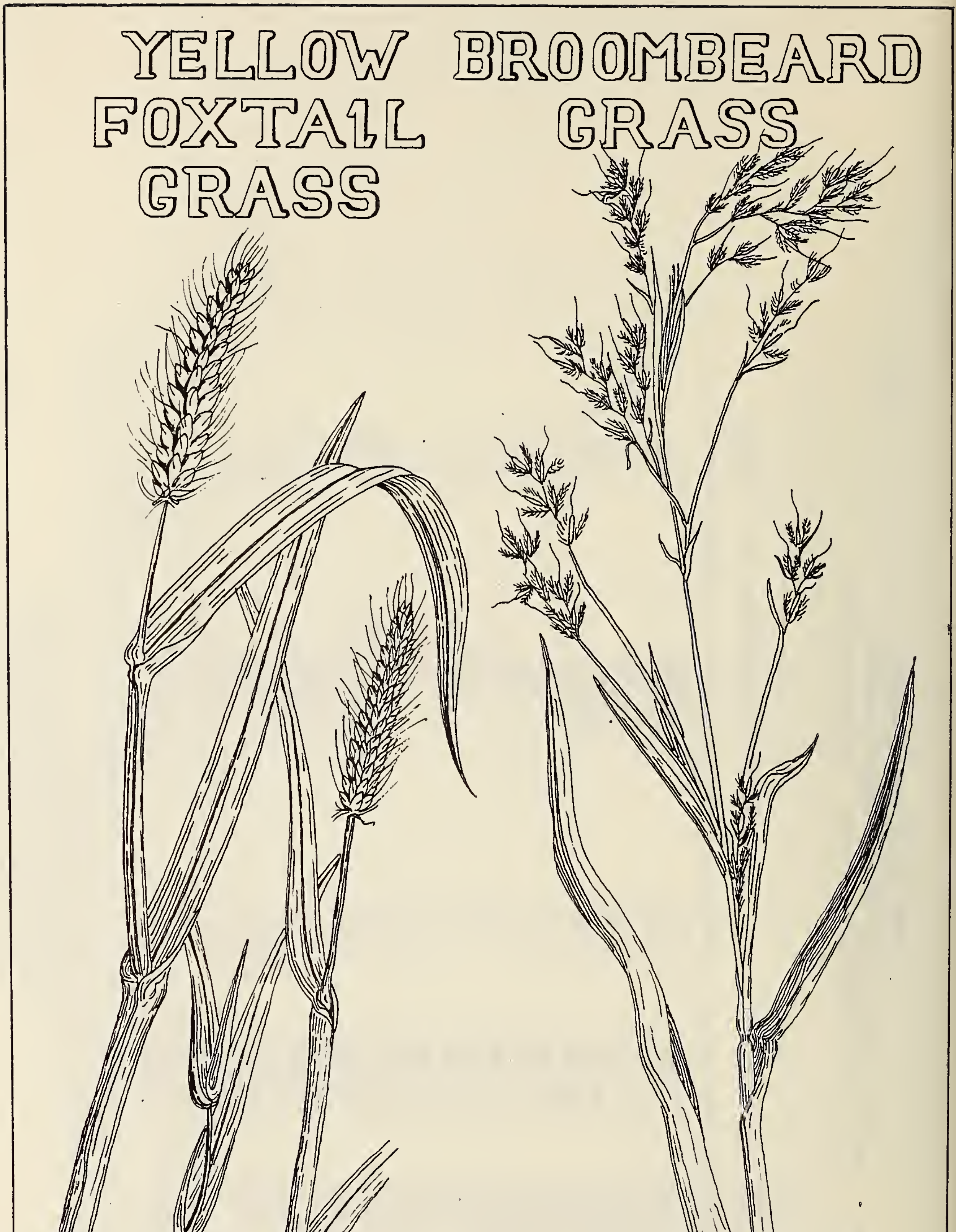
Note: 4N Jack Pine Needles

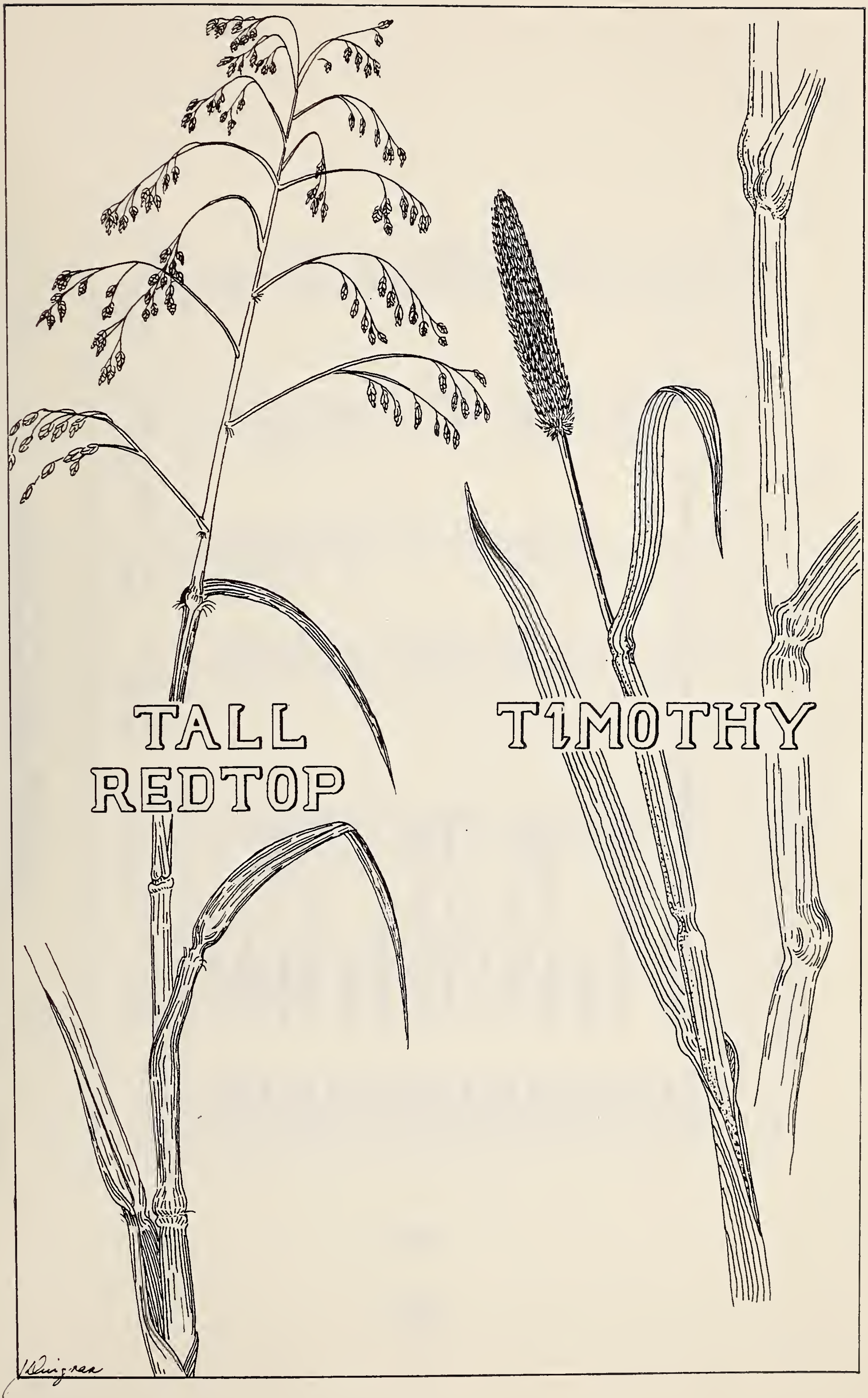
VEGETATION: Pine Needles
BACKGROUND SAMPLES SUMMARY
Paleozoic Bedrock: Southern Ontario

(d)

PARAMETER	AVERAGE CONCENTRATION (All Samples)
N ppm	16,000
P ppm	1,500
K ppm	4,800
Ca ppm	3,000
Mg ppm	1,800
Na ppm	400
S ppm	800
Se ppm	0.06
B ppm	19
As ppm	0.03
Ni ppm	0.71
Pb ppm	2.50
Cd ppm	-0.08
Cr ppm	0.56
Fe ppm	40
Mn ppm	30
Cu ppm	4.8
Zn ppm	32
Al ppm	52
Mo ppm	1.4
Co ppm	0.42
Hg ppm	0.058

Note: Based on one composite sample only.


YELLOW FOXTAIL GRASS
BROOMBEARD GRASS
Duignan


TALL
REDTOP
TIMOTHY

(a)

Note: "Unidentified Grasses" include the following:

Reed Canarygrass
Redtop
Kentucky Bluegrass
Climax Timothy
Tall Fescue
Creeping Red Fescue
Colonial Bentgrass
Canada Blue
Brome
Yellow Foxtail
Perennial Ryegrass
Broombeard
Bent Grass

VEGETATION: Grasses (excluding roots) (b)
TAILINGS TYPE: Uranium (Acid)

Parameter	Veg. Sample 18N	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 49N	Conc. in Tailings	Ratio Veg./Tail.
N ppm	7,190	80	90	10,650	30	355
P ppm	870	83	10.5	2,650	88	30
K ppm	11,500	5,900	1.9	12,600	11,200	1.1
Ca ppm	7,500	2,800	2.7	15,500	4,700	3.3
Mg ppm	2,600	530	4.9	3,700	200	18.5
Na ppm	-4	1,000	-0.00	35	400	0.09
S ppm	3,300	8,900	0.4	4,100	2,400	1.7
Se ppm	-1	-0.5	-2.0	-1	-0.5	-2.0
B ppm	---	-20	---	---	-20	---
As ppm	2	235	0.01	2	10	0.2
Ni ppm	-3	-2	-1.5	-3	2	-1.5
Pb ppm	8	40	0.2	10	220	0.04
Cd ppm	-1	-2	-0.5	-1	-2	-0.5
Cr ppm	-5	14	-0.4	-5	9	-0.6
Fe ppm	50	37,300	0.00	420	6,600	0.06
Mn ppm	400	45	8.9	-50	10	-5.0
Cu ppm	10	68	0.1	17	13	1.3
Zn ppm	18	14	1.3	10	5	2.0
Al ppm	---	17,300	---	---	27,100	---
Mo ppm	---	-15	---	---	-15	---
Co ppm	-2	17	-0.1	-2	7	-0.3
Hg ppm	---	0.04	---	---	0.06	---
V ppm	-6	20	-0.3	-6	-10	-0.6

Note: 18N unidentified grasses
49N unidentified grasses

VEGETATION: Grasses (excluding roots) (c)
TAILINGS TYPE: Uranium (Acid)

Parameter	Veg. Sample 3	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 4	Conc. in Tailings	Ratio Veg./Tail.
N ppm	12,600	30	420	13,000	40	325
P ppm	1,300	88	14.8	1,600	180	8.9
K ppm	17,000	11,200	1.5	13,500	6,800	1.99
Ca ppm	6,700	4,700	1.4	4,000	6,850	0.6
Mg ppm	1,800	200	9.0	2,000	150	13.3
Na ppm	400	400	1	500	290	1.7
S ppm	1,400	2,400	0.6	800	53,400	0.01
Se ppm	0.12	-0.5	=0.2	0.03	1.0	0.03
B ppm	8	-20	=0.4	9.0	-20	=0.5
As ppm	0.07	10	0.01	0.10	15	0.01
Ni ppm	1.79	2	0.9	1.07	14	0.08
Pb ppm	2.50	220	0.01	1.25	245	0.01
Cd ppm	-0.08	-2	-0.04	0.08	-2	=0.04
Cr ppm	1.76	9	0.2	0.88	15	0.06
Fe ppm	60	6,600	0.01	100	29,300	0.00
Mn ppm	41	10	4.1	180	10	18
Cu ppm	4.0	13	0.3	2.7	36	0.08
Zn ppm	6	5	1.2	28	13	2.2
Al ppm	45	27,100	0.00	57	23,100	0.00
Mo ppm	15.00	-15	=1.0	0.37	-15	=0.02
Co ppm	1.42	7	0.2	0.62	34	0.02
Hg ppm	0.066	0.06	1	0.066	0.10	0.7
V ppm	---	-10	---	---	-10	---

Note: 3 Timothy
4 unidentified grasses

VEGETATION: Grasses (excluding roots) (d)
TAILINGS TYPE: Uranium (Acid)

Parameter	Veg. Sample 5	Conc. in Tailings	Ratio Veg./Tail.
N ppm	18,500	40	463
P ppm	2,500	180	13.9
K ppm	5,900	6,800	0.9
Ca ppm	1,800	6,850	0.3
Mg ppm	1,800	150	12
Na ppm	300	290	1.03
S ppm	700	53,400	0.01
Se ppm	0.04	1.0	0.04
B ppm	8	-20	=0.4
As ppm	0.08	15	0.01
Ni ppm	1.07	14	0.08
Pb ppm	1.88	245	0.01
Cd ppm	-0.08	-2	-0.04
Cr ppm	0.74	15	0.05
Fe ppm	60	29,300	0.00
Mn ppm	24.88	10	2.5
Cu ppm	6.4	36	0.2
Zn ppm	50	13	3.8
Al ppm	45	23,100	0.00
Mo ppm	0.33	-15	=0.02
Co ppm	0.42	34	0.01
Hg ppm	0.063	0.10	0.6
V ppm	---	-10	---

Note: 5 Redtop

VEGETATION: Grasses (excluding roots) (e)
TAILINGS TYPE: Uranium (Acid)
SUMMARY: VEGETATION ANALYTICAL DATA

PARAMETER	AVERAGE CONCENTRATION All Samples	RANGE All Samples Low	RANGE All Samples High	AVERAGE RATIO VEG/TAIL. All Samples
N ppm	12,388	7,190	18,500	331
P ppm	1,784	870	2,650	12
K ppm	12,100	5,900	17,000	1.5
Ca ppm	7,100	1,800	15,500	1.7
Mg ppm	2,380	1,800	3,700	11.5
Na ppm	400	-4	500	0.8
S ppm	2,060	700	4,100	0.5
Se ppm	0.06	0.03	0.12	=0.09
B ppm	8.3	8	9.0	=0.4
As ppm	0.9	0.07	2	0.01
Ni ppm	-2.0	1.07	-3	-0.8
Pb ppm	1.9	1.25	10	0.05
Cd ppm	-0.4	-0.08	-1	-0.2
Cr ppm	-2.7	0.74	-5	-0.3
Fe ppm	68	50	420	0.01
Mn ppm	low 38.6 high 290	24.9	400	7.7
Cu ppm	8	2.7	17	0.4
Zn ppm	22.4	6	50	2.1
Al ppm	49	45	57	0.00
Mo ppm	0.35	0.33	15.0	=0.02
Co ppm	-1.3	0.42	-2	-0.1
Hg ppm	0.065	0.063	0.066	0.8
V ppm	-6	-6	-6	-0.5

Note: Data based on 5 composite samples.

VEGETATION: Grasses (excluding roots) (f)
TAILINGS TYPE: Uranium (Non-Acid)

Parameter	Veg. Sample 22N	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 15N	Conc. in Tailings	Ratio Veg./Tail.
N ppm	4,850	25	194	3,770	15	251
P ppm	600	353	1.7	320	265	1.2
K ppm	7,800	21,900	0.4	5,400	16,900	0.3
Ca ppm	12,700	12,010	1.1	13,000	26,010	0.5
Mg ppm	1,300	1,150	1.1	1,700	1,690	1.0
Na ppm	-4	17,800	-0.00	176	19,300	0.01
S ppm	3,300	5,500	0.6	6,800	18,100	0.4
Se ppm	-1	-0.5	-2	-1	-0.5	-2.0
B ppm	---	-20	---	---	-20	---
As ppm	-1	15	-0.1	2	15	0.1
Ni ppm	-3	2	-1.5	-3	24	-0.1
Pb ppm	13	65	0.2	9	180	0.05
Cd ppm	-1	-2	-0.5	-1	-2	-0.5
Cr ppm	-5	12	-0.4	-5	21	-0.2
Fe ppm	320	16,700	0.02	290	30,200	0.01
Mn ppm	950	305	3.1	800	845	0.9
Cu ppm	12	18	0.7	10	50	0.2
Zn ppm	83	49	1.7	160	222	0.7
Al ppm	---	49,800	---	---	50,200	---
Mo ppm	---	35	---	---	35	---
Co ppm	-2	9	-0.2	-2	23	-0.09
Hg ppm	---	0.01	---	---	0.09	---
V ppm	-6	25	-0.2	-6	40	-0.2

Note: 22N unidentified grasses
15N unidentified grasses

VEGETATION: Grasses (excluding roots) (g)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 19N	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 39N	Conc. in Tailings	Ratio Veg./Tail.
N ppm	3,970	47.5	84	5,420	61.2	89
P ppm	330	716	0.5	340	776	0.4
K ppm	1,500	40,700	0.04	2,100	35,000	0.06
Ca ppm	3,100	1,690	1.8	10,900	2,630	4.1
Mg ppm	1,400	3,310	0.4	1,300	5,160	0.3
Na ppm	15	19,100	0.00	-4	22,000	-0.00
S ppm	3,500	10,233	0.3	3,500	11,355	0.3
Se ppm	-1	2	-0.5	-1	-1	-1
B ppm	---	42	---	---	102	---
As ppm	2	80	0.03	2	117	0.02
Ni ppm	-3	90	-0.03	-3	-10	-0.3
Pb ppm	11	61	0.2	11	11	1
Cd ppm	-1	0.3	-3.3	-1	0.6	-1.7
Cr ppm	-5	159	-0.03	-5	107	-0.05
Fe ppm	110	31,500	0.00	70	33,400	0.00
Mn ppm	250	417	0.6	50	379	0.1
Cu ppm	3	50	0.06	5	78	0.06
Zn ppm	18	119	0.2	28	87.5	0.3
Al ppm	---	40,300	---	---	41,700	---
Mo ppm	---	4.4	---	---	4.3	---
Co ppm	-2	16	-0.1	-2	14	-0.1
Hg ppm	---	2.44	---	---	0.201	---
V ppm	-6	199	-0.03	-6	195	-0.03

Note: 19N unidentified grasses
39N unidentified grasses

VEGETATION: Grasses (excluding roots) (h)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 176	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 177	Conc. in Tailings	Ratio Veg./Tail.
N ppm	10,000	61.2	163	6,500	61.2	106
P ppm	1,100	776	1.4	1,100	776	1.4
K ppm	9,600	35,000	0.3	2,600	35,000	0.07
Ca ppm	4,800	2,630	1.8	4,900	2,630	1.9
Mg ppm	2,600	5,160	0.5	2,500	5,160	0.5
Na ppm	200	22,00	0.01	500	22,000	0.02
S ppm	800	11,355	0.07	600	11,355	0.05
Se ppm	-0.01	-1	-0.01	0.01	-1	=0.01
B ppm	20	102	0.2	31	102	0.3
As ppm	140	117	1.2	180	117	1.5
Ni ppm	3.83	-10	=0.4	5	-10	=0.5
Pb ppm	3.15	11	0.3	17	11	1.5
Cd ppm	0.23	0.6	0.4	0.31	0.6	0.5
Cr ppm	1.90	107	0.02	1.70	107	0.02
Fe ppm	1,430	33,400	0.04	2,145	33,400	0.06
Mn ppm	352	379	0.9	198	379	0.5
Cu ppm	5	78	0.06	9	78	0.1
Zn ppm	16	87.5	0.2	32	87.5	0.4
Al ppm	220	41,700	0.01	275	41,700	0.01
Mo ppm	5.33	4.3	1.2	2.66	4.3	0.6
Co ppm	1.83	14	0.1	2.04	14	0.1
Hg ppm	0.044	0.201	0.219	0.038	0.201	0.189
V ppm	---	195	---	---	195	---

Note: 176 Timothy
177 Foxtail Barley

VEGETATION: Grasses (excluding roots) (i)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 40N	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 42N	Conc. in Tailings	Ratio Veg./Tail.
N ppm	9,180	19.5	471	10,390	55.7	187
P ppm	1,410	157	9	1,030	815	1.3
K ppm	5,900	10,600	0.6	16,900	34,700	0.5
Ca ppm	6,400	2,400	2.6	11,500	2,700	4.3
Mg ppm	1,600	5,270	0.3	1,900	4,920	0.4
Na ppm	17	13,800	0.00	14	23,000	0.00
S ppm	6,400	4,496	1.4	4,300	105,894	0.04
Se ppm	-1	-1	-1	-1	10	-0.1
B ppm	---	100	---	---	76	---
As ppm	5	59	0.08	3	116	0.03
Ni ppm	-3	-10	-0.3	-3	25	-0.1
Pb ppm	3	17	0.2	2	26	0.08
Cd ppm	-1	0.3	-3.3	-1	0.6	-1.7
Cr ppm	-5	68	-0.07	-5	87	-0.06
Fe ppm	80	15,500	0.01	70	34,200	0.00
Mn ppm	400	107	3.7	100	338	0.3
Cu ppm	7	39	0.2	5	106	0.05
Zn ppm	47	48.8	1	15	77.1	0.2
Al ppm	---	28,600	---	---	45,200	---
Mo ppm	---	2.1	---	---	7.5	---
Co ppm	-2	20	-0.1	-2	27	-0.07
Hg ppm	---	0.020	---	---	2.27	---
V ppm	-6	78	-0.08	-6	138	-0.04

Note: 40N unidentified grasses
42N unidentified grasses

VEGETATION: Grasses (excluding roots) (j)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 168	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 41	Conc. in Tailings	Ratio Veg./Tail.
N ppm	14,000	13,9	1,007	10,000	64.1	156
P ppm	1,100	269	4.1	700	473	1.5
K ppm	9,400	7,840	1.2	6,000	14,500	0.4
Ca ppm	10,100	6,120	1.7	2,000	4,100	0.5
Mg ppm	1,600	12,000	0.1	1,300	8,390	0.2
Na ppm	300	6,410	0.05	300	4,880	0.06
S ppm	1,100	10,157	0.1	100	21,711	0.00
Se ppm	0.07	-1	=0.07	0.04	-1	=0.04
B ppm	36	104	0.3	7	84	0.08
As ppm	3	335	0.01	0.36	820	0.00
Ni ppm	0.99	37	0.03	1.43	-10	=0.1
Pb ppm	0.50	21	0.02	1.30	70	0.02
Cd ppm	-0.08	4.1	-0.02	-0.08	8.0	-0.01
Cr ppm	0.90	105	0.01	0.59	78	0.01
Fe ppm	121	69,600	0.00	100	58,300	0.00
Mn ppm	469	1,120	0.4	96	1,350	0.07
Cu ppm	4	153	0.03	4.3	98	0.04
Zn ppm	31	191	0.2	48	351	0.1
Al ppm	15	19,800	0.00	36	20,200	0.00
Mo ppm	0.62	-0.6	=1.0	0.29	-0.6	=0.5
Co ppm	0.58	2	0.3	0.50	30	0.02
Hg ppm	-0.025	0.450	-0.056	0.050	0.010	5.000
V ppm		153			140	

Note: 168 unidentified grasses
41 Timothy

VEGETATION: Grasses (excluding roots) (k)
TAILINGS TYPE: Gold (Non-Acid)

Parameter	Veg. Sample 43	Conc. in Tailings	Ratio Veg./Tail.
N ppm	11,000	27.8	396
P ppm	1,200	261	4.6
K ppm	9,200	1,170	7.9
Ca ppm	2,000	486	4.1
Mg ppm	1,600	2,330	0.7
Na ppm	300	875	0.3
S ppm	100	8,991	0.01
Se ppm	0.17	5	0.03
B ppm	8	82	0.1
As ppm	3.70	1,310	0.00
Ni ppm	1.07	-10	=0.1
Pb ppm	1.80	3,160	0.00
Cd ppm	0.17	18.3	0.01
Cr ppm	0.88	39	0.02
Fe ppm	260	348,000	0.00
Mn ppm	35	97	0.4
Cu ppm	4.4	1,860	0.00
Zn ppm	56	4,070	0.01
Al ppm	69	4,090	0.02
Mo ppm	0.33	-0.6	=0.6
Co ppm	0.58	74	0.01
Hg ppm	0.069	0.017	4.059
V ppm		28	

Note: 43 Foxtail Barley

VEGETATION: Grasses (excluding roots) (1)
TAILINGS TYPE: Gold (Non-Acid)
SUMMARY: VEGETATION ANALYTICAL DATA

PARAMETER	AVERAGE CONCENTRATION All Samples	RANGE All Samples Low	High	AVERAGE RATIO VEG/TAIL. All Samples
N ppm	8,940	3,970	14,000	295
P ppm	923	330	1,410	1.9
K ppm	5,788	1,500	16,900	0.4
Ca ppm	6,189	2,000	11,500	2.5
Mg ppm	1,756	1,300	2,600	0.4
Na ppm	low 12.5 high 320	-4	500	low 0.00 high 0.09
S ppm	2,267	100	6,400	0.1
Se ppm	-0.5	0.01	-1	0.3
B ppm	20.4	7	36	0.2
As ppm	2.6	0.36	180	0.03
Ni ppm	-2.7	0.99	5	0.2
Pb ppm	2.0	0.5	17	0.1
Cd ppm	-0.5	-0.08	-1	-1.2
Cr ppm	1.2	0.59	-5	-0.03
Fe ppm	92	70	2,145	0.00
Mn ppm	217	35	469	0.4
Cu ppm	5.2	3	9	0.07
Zn ppm	32.3	15	56	0.3
Al ppm	low 40 high 248	15	275	0.01
Mo ppm	low 0.4 high 4.0	0.29	5.33	=0.8
Co ppm	-1.5	0.50	2.04	-0.1
Hg ppm	-0.045	-0.025	0.069	-1.905
V ppm	-6	-6	-6	-0.05

Note: Data based on 9 composite samples representing several thousand individual plants.

VEGETATION: Grasses (excluding roots) (m)
TAILINGS TYPE: Sulphide (Acid) (Cu, Ni, Pb, Zn)

Parameter	Veg. Sample 38N	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 115	Conc. in Tailings	Ratio Veg./Tail.
N ppm	9,090	16.8	541	13,500	47.4	285
P ppm	920	400	2.3	2,100	330	6.4
K ppm	4,300	10,100	0.4	17,200	16,700	1.0
Ca ppm	13,800	793	17.4	11,200	2,370	4.7
Mg ppm	2,000	7,730	0.3	3,400	5,730	0.6
Na ppm	-4	8,130	-0.00	800	18,700	0.04
S ppm	3,900	17,383	0.2	2,300	13,410	0.2
Se ppm	-1	-1	-1	0.31	68	0.00
B ppm		103		76	100	0.8
As ppm	-1	20	-0.05	9.20	1,010	0.01
Ni ppm	-3	-10	-0.3	2.86	90	0.03
Pb ppm	14	226	0.06	50	1,293	0.04
Cd ppm	4	1.9	2.1	4.50	14.4	0.3
Cr ppm	-5	50	-0.1	5.29	89	0.06
Fe ppm	350	110,000	0.00	4,700	136,000	0.03
Mn ppm	50	357	0.1	531	188	2.8
Cu ppm	74	1,110	0.07	73.2	945	0.08
Zn ppm	575	4,940	0.1	966	1,660	0.6
Al ppm		32,200		999	36,500	0.03
Mo ppm		-0.6		0.44	2.8	0.2
Co ppm	-2	3	-0.7	5.75	160	0.04
Hg ppm		0.029			0.283	
V ppm	-6	-40	-0.2		40	

Note: 38N unidentified grasses
115 unidentified grasses

VEGETATION: Grasses (excluding roots) (n)
TAILINGS TYPE: Sulphide (Acid) (Cu, Ni, Pb, Zn)

Parameter	Veg. Sample 25262829	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 30	Conc. in Tailings	Ratio Veg./Tail.
N ppm	22,000	55.6	396	44,500	44.9	796
P ppm	1,450	666	2.2	3,900	825	4.7
K ppm	19,525	9,560	2.0	40,600	12,700	3.2
Ca ppm	2,325	3,780	0.6	5,600	7,550	0.7
Mg ppm	2,125	7,970	0.3	8,300	15,700	0.5
Na ppm	275	7,570	0.04	300	8,950	0.03
S ppm	2,125	19,214	0.1	3,200	6,260	0.5
Se ppm	0.30	15	0.02	0.26	10	0.03
B ppm	15.6	81	0.2	16	91	0.2
As ppm	0.27	269	0.00	0.21	258	0.00
Ni ppm	88	1,680	0.05	20.35	736	0.03
Pb ppm	2.10	23	0.09	2.50	21	0.12
Cd ppm	-0.23	1.9	-0.1	0.42	1.9	0.2
Cr ppm	4.48	269	0.02	5.88	417	0.01
Fe ppm	358	105,000	0.00	640	96,300	0.01
Mn ppm	242	876	0.3	93	835	0.1
Cu ppm	23.8	608	0.04	34.2	229	0.15
Zn ppm	23	110	0.2	40	129	0.3
Al ppm	97.3	28,200	0.00	105	36,900	0.00
Mo ppm	1.06	0.6	1.8	1.86	-0.6	=3.1
Co ppm	3.02	64	0.05	1.99	70	0.03
Hg ppm	0.081	0.088	0.920	0.062	0.034	1.824
V ppm		199			239	

Note: 25262829 unidentified grasses
30 unidentified grasses

VEGETATION: Grasses (excluding roots) (o)
TAILINGS TYPE: Sulphide (Acid) (Cu, Ni, Pb, Zn)
SUMMARY: VEGETATION ANALYTICAL DATA

PARAMETER	AVERAGE CONCENTRATION All Samples	RANGE All Samples Low	High	AVERAGE RATIO VEG/TAIL. All Samples
N ppm	22,273	9,090	44,500	505
P ppm	2,093	920	3,900	3.9
K ppm	20,431	4,300	40,700	1.7
Ca ppm	6,375	2,325	13,800	2.0
Mg ppm	3,956	2,000	8,300	0.4
Na ppm	458	275 (-4?)	800	0.04
S ppm	2,881	2,125	3,900	0.3
Se ppm	0.29	0.26	0.31	0.02
B ppm	16	15.6	76	0.4
As ppm	0.24	0.21	9.20	0.00
Ni ppm	data variable	2.86	88	0.4
Pb ppm	6.2	2.10	50	0.08
Cd ppm	-2.3	-0.23	4.50	-0.7
Cr ppm	5.22	4.48	5.88	0.03
Fe ppm	449	350	4,700	0.00
Mn ppm	229	50	531	0.8
Cu ppm	51	23.8	74	0.09
Zn ppm	data variable	23	966	0.3
Al ppm	101	97.3	999	0.01
Mo ppm	1.12	0.44	1.86	=1.7
Co ppm	3.6	1.99	5.75	0.04
Hg ppm	0.072	0.062	0.081	1.372
V ppm	-6			-0.2

Note: Data based on 7 composite samples of vegetation

VEGETATION: Grasses (excluding roots) (p)
TAILINGS TYPE: Sulphide (Non-Acid) (Cu)

Parameter	Veg. Sample 32	Conc. in Tailings	Ratio Veg./Tail.
N ppm	12,000	24	500
P ppm	800	229	3.5
K ppm	12,700	15,750	0.8
Ca ppm	6,600	4,075	1.6
Mg ppm	1,500	302	5.0
Na ppm	400	11,030	0.04
S ppm	1,300	14,069	0.09
Se ppm	0.04	5	0.01
B ppm	17	102	0.2
As ppm	3.25	201	0.02
Ni ppm	2.86	-10	=0.3
Pb ppm	3.13	43	0.07
Cd ppm	0.33	0.9	0.4
Cr ppm	1.76	93	0.02
Fe ppm	900	44,200	0.02
Mn ppm	285	422	0.7
Cu ppm	44	549	0.08
Zn ppm	40	152	0.3
Al ppm	30	32,450	0.00
Mo ppm	3.8	2.2	1.7
Co ppm	225	54	4.2
Hg ppm	0.051	0.046	1.109
V ppm		99	

Note: 32 Yellow Foxtail

VEGETATION: Grasses (excluding roots) (q)
TAILINGS TYPE: Refinery Residue (high As)

Parameter	Veg. Sample 124	Conc. in Tailings	Ratio Veg./Tail.	Veg. Sample 35N	Conc. in Tailings	Ratio Veg./Tail.
N ppm	13,000	20	650	10,150	20	508
P ppm	1,900	1,095	1.7	1,220	1,095	1.1
K ppm	4,300	300	14.3	12,300	300	41
Ca ppm	3,400	37,000	0.09	9,600	37,000	0.3
Mg ppm	800	30	26.7	1,600	30	53
Na ppm	500	260	1.9	90	260	0.3
S ppm	1,700	113,500	0.01	4,100	113,500	0.04
Se ppm	0.05	-0.5	=0.1	-1	-0.5	-2
B ppm	14	-20	=0.7		-20	
As ppm	1,500	34,000	0.04	90	34,000	0.00
Ni ppm	31.06	1,485	0.02	41	1,485	0.03
Pb ppm	6.25	68	0.09	-2	68	-0.03
Cd ppm	0.08	-2	=0.04	-1	-2	-0.5
Cr ppm	1.32	186	0.01	-5	186	-0.03
Fe ppm	900	80,000	0.01	540	80,000	0.01
Mn ppm	198	42	4.7	-50	42	-1.2
Cu ppm	16.5	6,880	0.00	22	6,880	0.00
Zn ppm	26	250	0.1	26	250	0.1
Al ppm	92	550	0.2		550	
Mo ppm	2.70	445	0.01		445	
Co ppm	22.72	2,650	0.01	19	2,650	0.01
Hg ppm	0.116	0.42	0.28		0.42	
V ppm		-8		-6	-8	-0.8

Note: 124 Broombeard
35N unidentified grasses

VEGETATION: Mixed Grasses (excluding roots) (r)
BACKGROUND SAMPLES SUMMARY
Paleozoic Bedrock: Southern Ontario

PARAMETER	AVERAGE CONCENTRATION (All Samples)
N ppm	24,200
P ppm	2,400
K ppm	25,600
Ca ppm	7,700
Mg ppm	3,400
Na ppm	500
S ppm	3,300
Se ppm	0.06
B ppm	9
As ppm	0.12
Ni ppm	0.71
Pb ppm	3.96
Cd ppm	-0.08
Cr ppm	0.86
Fe ppm	120
Mn ppm	320
Cu ppm	7
Zn ppm	42
Al ppm	69
Mo ppm	1.08
Co ppm	0.76
Hg ppm	0.059

Note: Data based on three composite samples of mixed grasses from two widely separated sites in Southern Ontario.

APPENDIX C

General Discussion

Factors Affecting
the
Accumulation of Substances
by Plants

Factors Affecting the Accumulation of Substances by Plants

1. TYPE OF PLANT

Plants differ considerably not only in their relative power to accumulate elements from the soil of a given composition but also in their response to increasing or decreasing amounts of the soil constituents under consideration. Each species may have, however, a characteristic mineral uptake which usually compensates to a considerable extent for an excess or deficiency of a particular element in a soil. Elemental accumulation depends to some extent on the class of plant involved. In general, the smaller and more primitive the species, the greater the enrichment coefficient for a particular element (enrichment coefficient $= \frac{\text{concentration in plant}}{\text{concentration in root.}}$)

One reason for the different degree of accumulation is probably that elemental concentrations in tissues may be a function of the translocation distance. Because the ions only have to travel a few millimeters to the leaves of lowly bryophytes, elemental concentrations should be far higher than in the leaves of a large tree with a long translocation distance between roots and outermost branches. Another reason for the different degree of accumulation may be due to the different type of transport mechanism used by the plant.

2. PLANT ORGAN

Specific plant organs differ in their relative power to assimilate elements from the soil. Elements are more likely to concentrate in actively growing tissue such as shoots.

Within individual organs there is sometimes strong evidence for antagonistic effects between different pairs of elements. Translocation distances may also effect the relative power of plant organs to accumulate soil elements.

3. AGE OF PLANT OR PLANT ORGAN

There is some evidence for appreciable variation in the elemental content of plants of the same species but of different ages. There is also strong evidence that the elemental content of certain plant organs, particularly leaves, is influenced by seasonal factors.

4. HEALTH OF THE PLANT

The health of the plant may affect the ability of the plant to accumulate trace elements.

5. THE pH OF THE SOIL

Uptake of elements by plants can be affected by the pH of the soil. Some plant species are particularly well adapted to growth at either extreme of the pH range. For example, plants common on calcareous soils contain very little soluble calcium because of the presence of intracellular oxalate which precipitates calcium as calcium oxalate.

CONTRASTING PROPERTIES OF CALCAREOUS AND ACID SOILS

CALCAREOUS	ACID
1. High in Calcium	1. Low in Calcium
2. High in pH & Carbonate	2. Low in pH; no carbonate
3. Rich in Nutrients	3. Poor in Nutrients
4. Solubility of Heavy Metal Ions Low	4. Solubility of Heavy Metal Ions High
5. Activity of Nitrogen Fixing & Nitrifying Bacteria High	5. Activity of Nitrogen Fixing & Nitrifying Bacterial Low

The importance of pH is two-fold. First, the pH influences the oxidation-reduction equilibrium and the solubility and ionic form of several elements. Drastic changes in pH can, therefore, affect the availability of certain elements to a significant degree.

Just as high concentrations of heavy metal ions in acid soils may limit the growth of certain plants, their low solubility in calcareous, high pH soils may also become a limiting factor.

The second aspect of pH has to do with the process of active ion absorption since hydrogen and hydroxyl ions have an effect on plant roots, especially on the ion transporting membranes of root cortical cells.

6. DEPTH OF ROOT SYSTEM

The depth of the root system will affect the degree of elemental uptake from the soil because, in general, the longer the root system, the less enrichment of elements in the upper part of the plant. The difference in values between shallow and deep-rooted specimens is probably a reflection of the greater difficulty of translocation of ions through a long root system.

7. DRAINAGE

Many elements become more mobile under waterlogged conditions and this will be reflected in greater uptake by plants.

Although increased elemental uptake due to drainage problems may not be as great as that caused by a genuine anomaly, any apparent anomalies associated with a change of the soil moisture should be taken into account.

8. ASPECT

The question of aspect is of importance in elemental accumulation by plants. For example, accumulation of elements from the soil is controlled by photosynthetic processes. Uptake will, therefore, be influenced to some extent by the intensity and duration of the light received by a plant.

Daily variations in rainfall received can also influence mineral uptake by plants. In many cases, the metal contents of the same plant species differ between sites of north and south aspect due to the combined effects of soil temperature and moisture content.

9. MUTUAL EFFECTS OF IONS

In respect to the absorption of a given element, the presence in the soil solution of another element may slow down the absorption of the given element, may accelerate it, or may have neither effect. The most common instance of the first kind is competition between two elements such that one element inhibits the uptake of another element. To explain these effects, related to toxic elements, the assumption is made that it is the result of some degree of unselectivity in absorption and utilization of chemically related elements. When an organic molecule is synthesized, the chance of substitution of the toxic element for the essential nutrient depends on the proportionate availability of the two.

Often the rate of absorption of a given element is entirely indifferent to the presence of another element as shown for absorption of potassium in the presence of excess sodium. This selectivity appears to depend absolutely on the presence of calcium in the solution. This interaction, however, is difficult to explain.

In summary:

FACTORS AFFECTING ELEMENTAL UPTAKE BY PLANTS

FACTOR	RELATIVE IMPORTANCE
Type of plant	Very great
Organ sampled	Great
Age of organ	Significant
Root depth	Significant
pH	Fairly significant
Health of plant	Fairly significant
Drainage	Fairly significant
Availability of elements	Minor
Antagonism of other elements	Minor
Rainfall	Minor
Variable shading	Minor
Temperature of soil	Minor

APPENDIX D

General Comments

Toxicity in Plants

It has been suggested that elements can be divided into three classes according to their toxicities towards plants:

(1) VERY TOXIC

Toxicity symptoms appear at concentrations less than 1 ppm in the substrate. Such elements include beryllium, copper, mercury, silver and tin.

(2) MODERATELY TOXIC

Toxicity symptoms appear at concentrations between 1 and 100 ppm in the substrate. Examples of this are the transition elements and most of the elements of Groups III, IV, V and VI of the periodic table.

(3) RELATIVELY NON-TOXIC

Toxicity symptoms rarely appear at concentrations normally encountered in the substrate. Examples of such elements are the halogens, nitrogen, phosphorus, sulphur, titanium, the alkali metals and the alkaline earths.

The above classification applies to vascular plants rather than bryophytes and the data are based on concentrations of the elements in nutrient solutions where the whole concentration is assumed to be available to the plant. Where plants are found under natural conditions, substantially higher concentrations of these elements can be tolerated in the soil, provided that availability is low.

The most common mechanisms of toxic action in plants appear to be as follows:

POISONING OF ENZYMES

The more electronegative metals such as copper, mercury and silver have a great affinity for sulfhydryl groups which are reactive sites for many enzymes. The enzyme is, therefore, unable to function and toxicity results.

REPLACEMENT OF ESSENTIAL NUTRIENTS

Arsenate and chlorate can occupy sites normally involving phosphate and nitrate respectively. Phosphorus and nitrate deficiency symptoms can therefore appear in a plant.

PRECIPITATION OF ESSENTIAL NUTRIENTS

Elements such as aluminum, beryllium and titanium readily precipitate phosphate rendering it unavailable to the plant. In this way, phosphorus deficiency can result.

CATALYTIC DECOMPOSITION OF ESSENTIAL NUTRIENTS AND METABOLITES

Elements such as lanthanum have a strong catalytic action on the decomposition of metabolites such as ATP.

COMBINATION WITH THE CELL MEMBRANE AND REDUCTION OF ITS PERMEABILITY

Elements such as copper, gold, lead and mercury are able to reduce the permeability of the cell membrane and prevent the free passage of substances such as sodium, potassium and diverse organic molecules.

REPLACEMENT OF STRUCTURALLY IMPORTANT ELEMENTS IN A CELL

Some elements can replace others in a cell but have an inert physiological role. Examples of this type of replacement are the replacements of sodium by lithium and of chlorine by bromine.

APPENDIX E

ROUTINE RELATIVE PARAMETER LEVELS IN VEGETATION

The following is a brief account of the observed routine relative parameter levels in the species of vegetation tested for this report:

KEY

(B) Parameter level higher in plants growing on "uncontaminated" (background) sites

(T) Parameter level higher in plants growing on "contaminated" (tailings) sites

(N) No routine significant difference in parameter level between plants growing on "contaminated" vs. "uncontaminated" sites.

(1) Nitrogen

Cattail leaves	(N)
Horsetail	(B)
Birch leaves	(N)
Poplar leaves	(N)
Aspen leaves	(B)
Fleabane	(T)
Vetch	(B)
Maple leaves	(T)?
Willow leaves	(B)
Trefoil	(B)
Purple Clover	(N)
Yellow Sweet Clover	(N)
Evergreen Needles	(B)
Grasses	(B)

Conclusion: Levels in plants growing on tailings not significant.

(2) Phosphorus

Cattail leaves	(T)?
Horsetail	(B)
Birch leaves	(N)
Poplar leaves	(N)
Aspen leaves	(B)
Fleabane	(N)
Vetch	(N)
Maple leaves	(N)
Willow leaves	(B)
Trefoil	(B)
Purple Clover	(N)
Yellow Sweet Clover	(N)
Evergreen Needles	(B)
Grasses	(B)

Conclusion: Levels in plants growing on tailings not significant.

(3) Potassium

Cattail leaves	(T)
Horsetail	(N)
Birch leaves	(N)
Poplar leaves	(T)
Aspen leaves	(T)
Fleabane	(T)
Vetch	(T)
Maple leaves	(T)
Willow leaves	(N)
Trefoil	(B)
Purple Clover	(N)
Yellow Sweet Clover	(N)
Evergreen needles	(N)
Grasses	(B)

Conclusion: Potassium levels sometimes elevated in plants growing on tailings areas. Not environmentally significant.

(4) Calcium

Cattail leaves	(N)
Horsetail	(B)
Birch leaves	(N)
Poplar leaves	(N)
Aspen leaves	(T)
Fleabane	(T)
Vetch	(T)
Maple leaves	(T)
Willow leaves	(B)
Trefoil	(B)
Purple Clover	(B)
Yellow Sweet Clover	(B)
Evergreen needles	(T)
Grasses	(N)

Conclusion: Some levels elevated in plants growing on tailings areas. No environmental significance.

(5) Magnesium

Cattail leaves	(N)
Horsetail	(B)
Birch leaves	(N)
Poplar leaves	(B)
Aspen leaves	(T)
Fleabane	(T)?
Vetch	(T)
Maple leaves	(N)
Willow leaves	(N)
Trefoil	(T)
Purple Clover	(N)
Sweet Yellow Clover	(T)
Evergreen needles	(N)
Grasses	(B)

Conclusion: Elevated in a few cases in plants growing on tailings areas. No environmental significance.

(6) Sodium

Cattail leaves	(B)
Horsetail	(N)
Birch leaves	(B)
Poplar leaves	(B)?
Aspen leaves	(T)
Fleabane	(T)
Vetch	(B)
Maple leaves	(T)
Willow leaves	(B)
Trefoil	(T)?
Purple Clover	(N)
Yellow Sweet Clover	(B)
Evergreen needles	(B)
Grasses	(B)

Conclusion: Elevated levels uncommon in plants growing on tailings. No environmental significance.

(7) Sulphur

Cattail leaves	(T)
Birch leaves	(T)
Poplar leaves	(T)
Aspen leaves	(T)
Fleabane	(T)
Vetch	(T)
Maple leaves	(T)
Willow leaves	(B)
Trefoil	(B)
Purple Clover	(N)?
Yellow Sweet Clover	(T)
Grasses	(N)

Conclusion: Sulphur levels are elevated in a number of plant types growing on tailings areas. Not of environmental significance.

(8) Selenium

Cattail leaves	(T) Sulphides only
Horsetail	(N)
Birch leaves	(N)
Poplar leaves	(T) Sulphides only
Aspen leaves	(N)
Fleabane	(B)
Maple leaves	(N)
Willow leaves	(N)
Trefoil	(N)
Purple Clover	(N)?
Yellow Sweet Clover	(N)?
Evergreen needles	(N)?
Grasses	(N)

Conclusion: Levels slightly elevated in some plants growing on sulphide disposal areas. Nothing spectacular. Probably of no environmental concern.

(9) Boron

Cattail leaves	(N)
Horsetail	(N)
Birch leaves	(N)?
Poplar leaves	(N)
Aspen leaves	(T)
Fleabane	(T)
Maple leaves	(T)
Willow leaves	(N)
Trefoil	(B)
Purple Clover	(N)
Yellow Sweet Clover	(N)
Evergreen needles	(N)
Grasses	(T)?

Conclusion: Elevated levels in a few instances when plants growing on tailings areas. Nothing extreme. Of little environmental concern.

(10) Arsenic

Cattail leaves	(T)
Horsetail	(T) occasionally high levels
Birch leaves	(T)
Poplar leaves	(T)
Aspen leaves	(N)
Fleabane	(T) high levels
Maple leaves	(T) high levels
Willow leaves	(T)
Purple Clover	(N)?
Yellow Sweet Clover	(T)
Evergreen needles	(T) sometimes high
Trefoil	(T) moderate levels
Grasses	(T) sometimes high

Conclusion: Levels of arsenic routinely elevated in plants growing on mine waste disposal areas. Due to its known toxicity to humans etc., arsenic in vegetation does present serious potential environmental problems.

(11) Nickel

Cattail leaves	(T) moderate levels
Birch leaves	(T)
Poplar leaves	(T)
Aspen leaves	(T) high levels
Fleabane	(T) high levels
Maple leaves	(T) high levels
Willow leaves	(T) high levels
Trefoil	(T)
Purple Clover	(T) high levels
Sweet Yellow Clover	(T)
Evergreen needles	(N)
Grasses	(T) sometimes high levels

Conclusion: Nickel levels are routinely elevated in plants growing on mine waste disposal sites. A potential environmental problem.

(12) Lead

Cattail leaves	(N)?
Horsetail	(N)
Birch leaves	(N)
Poplar leaves	(N)?
Aspen leaves	(N)
Fleabane	(B)
Vetch	(T)
Maple leaves	(N)?
Willow leaves	(B)
Trefoil	(B)
Purple Clover	(B)
Sweet Yellow Clover	(T)
Evergreen needles	(T)
Grasses	(N)?

Conclusion: Lead levels are sporadically elevated in plants growing on tailings areas. Given the known toxicity of lead to humans, a potential environmental problem exists.

(13) Cadmium

Cattail leaves	(N)
Horsetail	(B)
Birch leaves	(N)
Poplar leaves	(N) exception: acid sulphides
Aspen leaves	(B)
Fleabane	(B)
Maple leaves	(N)
Willow leaves	(B)
Trefoil	(N)
Purple Clover	(N)
Yellow Sweet Clover	(N)
Evergreen needles	(N)
Grasses	(N)

Conclusion: While elevated levels do appear in poplar leaves (plants growing on acid sulphide areas), cadmium in general does not appear to present an environmental problem.

(14) Chromium

Cattail leaves	(T)
Horsetail	(N)
Birch leaves	(N)
Poplar leaves	(N)
Aspen leaves	(T)?
Fleabane	(T)
Maple leaves	(N)
Willow leaves	(B)?
Trefoil	(N)
Purple Clover	(T)
Evergreen needles	(N)
Grasses	(T)

Conclusion: Levels in plants growing on tailings not environmentally significant.

(15) Iron

Cattail leaves	(T)
Horsetail	(T)
Birch leaves	(T)
Aspen leaves	(T)
Fleabane	(T)
Vetch	(T)
Maple leaves	(T)
Willow leaves	(B)
Trefoil	(N)?
Purple Clover	(T)?
Sweet Yellow Clover	(T)
Evergreen needles	(T)
Grasses	(T)

Conclusion: Levels are elevated in plants growing on tailings areas. However, due to the innocuous nature of the substance, no environmental impacts are anticipated.

(16) Manganese

Cattail leaves	(T)?
Horsetail	(B)
Poplar leaves	(B)?
Aspen leaves	(T)
Fleabane	(T)
Vetch	(B)
Maple leaves	(B)
Willow leaves	(T)
Trefoil	(N)?
Purple Clover	(T)
Evergreen needles	(T)
Grasses	(B)?

Conclusion: Elevated levels are seen in some plants growing on tailings areas. However, due to the nature of the substance, no environmental impacts are expected.

(17) Copper

Cattail leaves	(T)
Horsetail	(N)
	(T) sulphides
Birch leaves	(T)
Poplar leaves	(N)
	(T) acid sulphides
Aspen leaves	(N)
Fleabane	(T)
Vetch	(T)
Maple leaves	(N)
Willow leaves	(N)
Trefoil	(B)
Purple Clover	(N)?
Sweet Yellow Clover	(T)?
Evergreen needles	(N)
Grasses	(T)

Conclusion: Copper levels are commonly elevated in plants growing on mineral tailings; however, these levels are not commonly highly elevated. Due to the known toxic effects of excessive amounts of copper, potential environmental problems exist.

(18) Zinc

Cattail leaves	(N)? (T) acid sulphides
Horsetail	(T)?
Birch leaves	(T)?
Poplar leaves	(N)? (T)? acid sulphides
Aspen leaves	(T)
Fleabane	(B)
Vetch	(B)
Maple leaves	(N)
Willow leaves	(T)
Trefoil	(N)
Purple Clover	(N)
Yellow Sweet Clover	(N) (T)? acid sulphides
Evergreen needles	(T)
Grasses	(N) (T) Non-Acid Uranium Acid Sulphide

Conclusion: Levels difficult to predict. A potential environmental problem.

(19) Aluminum

Cattail leaves	(N)
	(T) Acid and Non-Acid Sulphides
Horsetail	(N)
	(T) Acid Sulphide Non-Acid Uranium
Birch leaves	(N) or (B)
Poplar leaves	(N)
	(T) Acid Sulphides
Aspen leaves	(B)
Fleabane	(N)
Maple leaves	(N)
Willow leaves	(B)
Trefoil	(T)?
Purple Clover	(T)
Evergreen needles	(T)?
Grasses	(N)?
	(T) Acid Sulphides

Conclusion: Probably not an environmental problem in the context of this report.

(20) Molybdenum

Cattail leaves	(T)
Birch leaves	(T)
Poplar leaves	(T)
Aspen leaves	(T)
Fleabane	(T)
Maple leaves	(T)
Willow leaves	(T)
Trefoil	(T)
Purple Clover	(T)
Yellow Sweet Clover	(T)
Evergreen needles	(B)
Grasses	(T)

Conclusion: Elevated levels in plants growing on tailings routine. A potential environmental problem.

(21) Cobalt

Horsetail	(T)
Birch leaves	(T)
Poplar leaves	(T)
Aspen leaves	(T)
Fleabane	(T)
Maple leaves	(N)?
Willow leaves	(B)?
Trefoil	(T)
Purple Clover	(T)
Evergreen needles	(N)?
Grasses	(T)

Conclusions: Levels commonly elevated in plants growing on mineral tailings deposits. A potential environmental problem.

(22) Mercury

Cattail leaves	(B)
Horsetail	(B)
Birch leaves	(N) or (B)
Poplar leaves	(N)?
Aspen leaves	(B)
Fleabane	(T)
Maple leaves	(N)?
Willow leaves	(B)
Trefoil	(N)?
Purple Clover	(T)
Yellow Sweet Clover	(B)
Evergreen needles	(B) or (N)
Grasses	(N)?

Conclusion: Always presents a potential concern. In the context of this report, however, there does not seem to be any evidence that suggests a serious problem.

MOE/LEV/ALOL 1984
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Levels of metals and
non metals in alol
c.1 a aa

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